73

FEBRUARY 1965

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Amateur Radio

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. . . you will do it better, more efficiently, and at a lower cost with a CUSH CRAFT ANTENNA.

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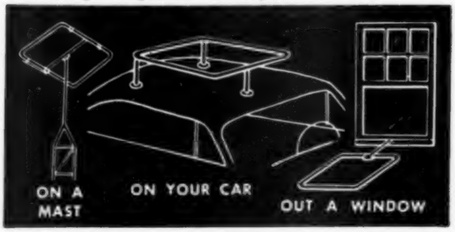
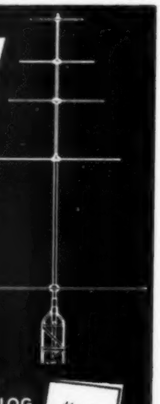
SQUALO is a full half wave, horizontally polarized, omni-directional antenna. Outstanding all around performance is achieved through a 360° pattern with no deep nulls. The square shape allows full electrical length in compact dimensions. Direct 52 ohm Reddi Match feed provides ease of tuning and broad band coverage.

The 6 meter Squalos are completely universal for mounting anywhere. They are packaged with rubber suction cups for car top mounting and a horizontal center support for mast or tower mounting. The 10—15—20 and 40 meter Squalos are designed for mast or tower mounting. Squalo is ideal for net control, monitoring, or general coverage.



MODEL NUMBER	DESCRIPTION	NET PRICE
ASQ-2	2 Meter 10" square	$ 8.45
ASQ-6	6 Meter 30" square	12.50
ASQ-10	10 Meter 50" square	19.50
CSQ-11	11 Meter 50" square	19.50
ASQ-15	15 Meter 65" square	23.50
ASQ-20	20 Meter 100" square	29.50
ASQ-40	40 Meter 192" square	66.50

SQUALO TREE



Design a complete multi band antenna system to meet your own requirements. Squalos can be mounted one above the other or above existing beams on a single mast. The Squalo tree is a horizontally polarized, omnidirectional system in any combination of the 6 through 40 meter amateur bands. The Squalo tree takes a minimum amount of space, and does not require extra radials, ground wires, or rotators common to most multi band systems.

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621 HAYWARD ST MANCHESTER N. H.

73

Magazine

Wayne Green W2NSD/1
Editor & Publisher

Paul Franson WA4HWH/1
Assistant Editor

February, 1965

Vol. XXVIII, No. 1

Cover by K3SUK

73's Advertising Rates

	1-5 times	6-11 times*	12 times*
2 pages	$520	$488**	$456**
1 page	268	252**	236**
1/2 page	138	130	122
1/4 page	71	67	63
1/8 page	37	35	33
1/16 page	20	19	18

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de W2NSD/1

never say die

Institute of Amateur Radio

During Christmas week I got together with the Directors of the Institute in Washington to review our progress during 1964 and map our course for 1965.

I think that all of us were amazed at how much our small group of less than 700 amateurs had accomplished in one short year. Now, for the first time in history, amateur radio has a bonafide lobbying organization in Washington to represent amateur radio. A Congressional Amateur Radio Newsletter has been established to bring news of amateur radio accomplishments and service to the members of the House and Senate. Amateur radio is now, for the first time, in a position to protect itself from the pressures of commercial and even government interests.

Plans for increasing our effectiveness with Congress were discussed and a preliminary approach to the international promotion of amateur radio was developed.

Considerable concern over the gradual swallowing of the League by QST was expressed and we are intent that this pattern shall not be repeated with the Institute. A study of the current balance sheets of the ARRL indicate that about 90% of the income of the League goes for their publishing business and only about 10% for matters of benefit to the members. This means that about $4.50 of each $5.00 membership/subscription goes for the magazine and about 50¢ for membership benefits. Thus, unless this same pattern is permitted to repeat itself, the Institute should be able to match the current efforts of the League for the amateurs with a membership of about 7,000. For that matter, if we continue to get as much mileage from our income as we have during the last year we may match their efforts with a lot smaller group than that.

But just matching their efforts is not going to do much for the survival of amateur radio, and this is our major concern.

A review of our actual expenses in setting up the Institute, organizing the Washington office, establishing the Amateur Radio Congressional Newsletter, registering with both the House and Senate as an official lobbying group for amateur radio and administering memberships showed that we had spent far less than we had thought possible. We had achieved our first years goals and ended the year with over $3000 in the bank! In view of the savings which had been effected it was decided to automatically extend all Founding Memberships for an extra year and to reduce the yearly dues to $5.00. So many members had asked for some arrangement for a combination membership in the Institute and subscription to 73 that it was decided to accept the two together for $7.00 per year. It was definitely decided not to force 73 subscribers to join the Institute or to force Institute members to subscribe to 73, as is the present case with ARRL and QST.

Clubs

Against my better judgement we're giving such a fabulous deal for clubs that it makes me sick. If your club secretary doesn't write in immediately for full details on how to save money on subscriptions and fill the club coffers, simultaneously qualifying 73 as a disaster area for Poverty Corps attention, you'd better take his ARRL pin away and demote him to Sergeant-At-Arms.

Stamp

Perhaps you've noticed that I did not put that crumby stamp on the cover of 73 this month. My postmaster called a few weeks

NOW DIRECT CRYSTAL CONTROL TO 160 mc With AOC Plug-In Transistor Oscillators

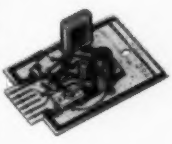
- Portable Signal Standards
- Signal Generators For Receiver Alignment
- Band Edge Markers
- Frequency Markers For Oscilloscopes
- Quick-Change Plug-In Oscillators
- Accessory Cases

HIGH FREQUENCY (20 mc – 160 mc)

Five transistor oscillators covering 20 mc - 160 mc. Standard 77°F calibration tolerance ±.0025%. The frequency tolerance is ±.0035%. Oscillator output is .2 volts (min) across 51 ohms. Power requirement: 9 vdc @ 10 ma. max.

OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40°F to 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-24	20-40 mc	CY-7T	±.0035%	$ 9.10
OT-46	40-60 mc	CY-7T	±.0035%	9.10
OT-61	60-100 mc	CY-7T	±.0035%	15.00
OT-140	100-140 mc	CY-7T	±.0035%	15.00
OT-160	125-160 mc	CY-7T	±.0035%	15.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
20-60 mc	$ 6.90
60-100 mc	12.00
101-140 mc	15.00
141-160 mc	18.00



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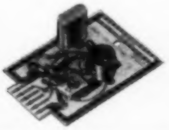
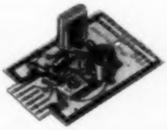
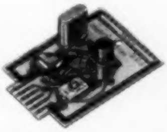
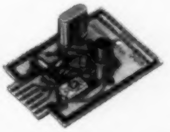






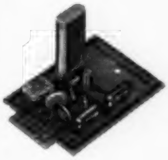


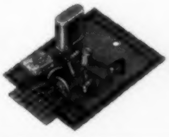
LOW FREQUENCY (70 kc – 20,000 kc)

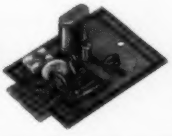
Four transistor oscillators covering 70 kc - 20,000 kc. Trimmer capacitor for zeroing crystal. When oscillator is ordered with crystal the standard will be ± .0025%. Oscillator output is 1 volt (min) across 470 ohms. Power requirement: 9 vdc @ 10 ma. max.

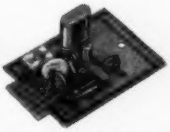
OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40°F TO + 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-1	70-200 kc	CY-13T	±.015%	$7.00
OT-2	200-5,000 kc	CY-6T	200-600kc ±.01% 600-5,000kc ±.0035%	7.00 7.00
OT-3	2,000-12,000 kc	CY-6T	±.0035%	7.00
OT-4	10,000-20,000 kc	CY-6T	±.0035%	7.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
70-99 kc	$22.50
100-200 kc	15.00
200-499 kc	12.50
500-849 kc	22.50
850-999 kc	15.00
1,000-1,499 kc	9.80
1,500-2,999 kc	6.90
3,000-10,999 kc	4.90
11,000-20,000 kc	6.90









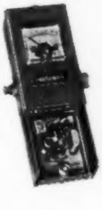
INTERNATIONAL
CRYSTAL MFG. CO., INC.
18 NORTH LEE OKLAHOMA CITY, OKLA.

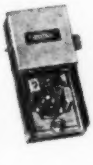
AOC OSCILLATOR CASES

Small portable cases for use with the OT series of plug-in oscillators. Prices do not include oscillators. (When oscillator and crystal are ordered with FOT-10 case a 77° F tolerance of ±.001% may be obtained at $2.00 extra per oscillator/crystal unit. When oscillator/crystal units are ordered with FOT-20 case, a single unit can be supplied with temperature calibration over a range of 40° F to 120° F. Correction to ±.0005%. Add $25.00 to the price of FOT-20 and oscillator/crystal unit.)

FOT-20

FOT-10





FOT-20	For high accuracy calibration requirements. Includes battery and output jack, output meter circuit and battery check, as well as thermistor temperature measuring circuit. **$87.50**
FOT-10	Basic case with battery and output jack for general wider tolerance applications. **$14.50**
MT-1	Oscillator board mounting kit. **$4.95**

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CRANK-UP
TOWERS
Why settle
for less
than the best?
K7ASK

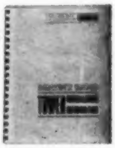
TWO CATEGORIES TO CHOOSE FROM

Standard Duty Guyed in Heights of 37 - 54 - 88 - 105 and 122 feet

Heavy Duty Self Supporting and Guyed in Heights of 37 — 54 feet (SS) 71 — 88 feet (guyed)

ROHN has these 6 IMPORTANT POINTS:

Ease of Operation—roller guides between sections assure easy, safe, friction-free raising and lowering. **Strength**—welded tubular steel sections overlap 3 feet at maximum height for extra sturdiness and strength. Unique ROHN raising procedure **raises all sections together**—uniformly with an equal section overlap at **all** heights! **Versatility**—designed to support the largest antennae with complete safety and assurance **at any height desired!** **Simple Installation**—install it yourself—use either flat base or special tilting base (illustrated above) depending on your needs. **Rated and Tested**—entire line engineered so you can get exactly the **right** size and properly rated tower for **your** antenna. The ROHN line of towers is **complete**. **Zinc Galvanized**—hot dipped galvanizing a standard—not an extra—with all ROHN towers! Prices start at less than $100.



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ROHN Manufacturing Co.

P. O. Box 2000 **Peoria, Illinois**

"World's Largest EXCLUSIVE Manufacturer of Towers; designers, engineers, and installers of complete communication tower systems."

before it came out and asked if I wanted him to get any extra copies of the stamp. I enthusiastically told him to stock up heavily for us. Then the thing came out. Very depressing. A pointless design indicative of nothing, printed in embalmer' purple. When the first one came in I sat there and looked at it in dismay. This was it . . . the amateur radio stamp . . . the *only* stamp amateur radio would probably ever have . . . and it was terrible.

Gronouski (PMG) had been turning out some great stamps with his new four color offset press. Purple we got. I was hoping for something nice like a portrait of Hiram Percy Maxim or perhaps a Wouf-Hong. So what do I see? An AM modulation envelope, a Collins knob, and some calibration. Well, they can use the same stamp with a slight word change to commemorate CB.

Microwaves

We have a few good article coming up on microwave gear, but we'd sure like to have a lot more of them. If you're working on ham microwave stuff why not unstinge and turn loose of some of your trade secrets. After all, the worst that can happen is that others will falter along in your footsteps. We pay good like a magazine should.

Draftsmanship

We seem to have more drafting for 73 and some of the books we have in preparation for publication than our present corps of draftsmen can handle. Is there anyone out there with radio drafting experience (and templates) who is interested in a few spare dollars for copious quantities of their time?

Thud

The Christmas thaw which hit New England opened up the road to the VHF shack on 73 Mountain. Val, K1APA, and I gave it a try in the new 73 Mercedes and made it all OK. It was so cold that we zipped right into the house . . . to be met by an equal and identical cold . . . it was 19° in and out of the house. We turned on the electric heater and the two meter rig and soon had the temperature up to a cozy 28°. I tuned two and heard a lot of silence. Hmmm. A short CQ brought an answer from down in New Jersey. I switched antennas and found that the 48 didn't seem to be working . . . the 96 element was doing fine and the 192 element was weak.

Val went out . . . took a quick look and hol-

(Continued on page 88)

COMMAND THE BAND

1000
1500
2000
HAMMARLUND HXL-ONE

with the NEW HAMMARLUND HXL-1 linear amplifier

Regardless of the exciter you are now using—the HX-50, the HX-500, or any one of a host of compatible competitive units, you will TAKE COMMAND the moment you're hooked up to the incredible HXL-1.

The HXL-1 is so rugged, it can be held "key down" at a kilowatt for more than an hour . . . without damage. It delivers the full metered legal power of 1 KW CW input—1500 W PEP input. Here is a "no-nonsense" linear that delivers the power you pay for—the performance you want.

Send for complete technical literature today—or see and try it at your nearest authorized Hammarlund distributor.

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- **Complete coverage—80 to 10 meters**
- **Broad Banded Input Circuit**
- **3 Element adjustable Pi-network output**
- **Built-in multi-purpose meter including linearity test**
- **Control circuitry compatible with most transmitters and transceivers (i.e. HX-50, HX-500, "S" line and KWM1, KWM2, etc.)**
- **Efficient Ground-grid circuit using 2 high dissipation triodes (United 572A)**
- **Husky, self-contained solid state power supply with silicon rectifiers**
- **Only connection required between exciter and amplifier is a coax cable. All relay switching built into amplifier.**
- **Power packed performance on SSB, CW and AM. 1500W PEP input; 1 KW CW input**
- **Designed for 115/230 volt operation**
- **Same physical size as the Fabulous HX-50. (17½" wide; 9½" deep; 9⅛" high)**

Established 1910

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Cable Address: SUPERPRO

Allan W. Crowell WA6OQP
151 Estates Drive
Santa Cruz, Calif.

The Ham and TVI

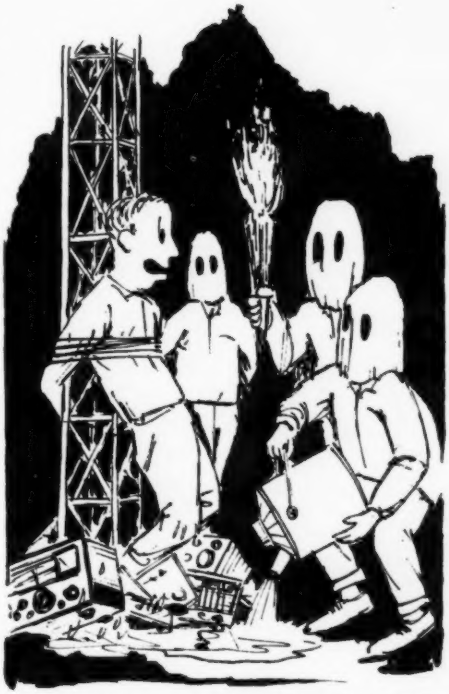
Cartoons by K3SUK.

Looking for new fields to conquer? One such area is in improving the relationship between John (or Jane) Q. Public and amateur radio. You can easily get yourself appointed chairman of the local radio club TVI committee. Here is a chance to help both the public and the amateur, and while the pay is low (low? it's zero!), the personal satisfaction of contributing to the public service by solving interference problems can be great. Actually, the designation TVI is a misnomer because it represents only one type of interference in a two way street, interference by an amateur to the public and interference to the amateur by the public (including utilities). It appears in many forms, TVI, BCI, Hi-Fi, CBI, power leaks, and diathermy to point out but a few.

Interested? Curious to know how to go about being a TVI committee? It's really quite simple and there is no magic involved in solving the problems. The solution to each requires the proper handling of several fundamental points. Let's use a hypothetical case as an example of the technical and operational approach. Keep in mind however, that the principles apply to any type of interference investigation.

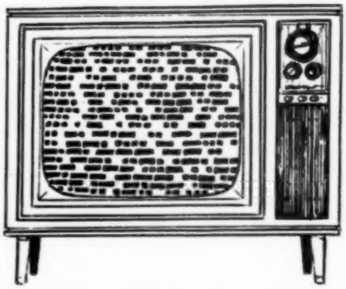
You are minding your own business at home one night when the telephone rings. It's a poor downtrodden local ham who tells you he has been threatened with bodily harm by a little old lady down the street who hears his voice on her TV set, and if that isn't bad enough, the picture looks like the results of a runaway mixmaster. Your first job is to calm him down if necessary and assure him that you will jump right in and make an impartial investigation of the complaint. Only generalities can be discussed on the phone so make a date to visit his station, and at this time begin filling out your investigaton report. Leave nothing to memory, particularly the technical findings you will uncover. Some report headings are: 1. date of complaint and by whom notified, 2. name, address, and radio call of the alleged offending party (alleged is used here because sometimes the wrong person is blamed for the interference, 3. alleged interfering equipment, including antenna system and block diagram, 4. your technical findings regarding the interfering equipment before and after any equipment changes or adjustments, 5. name and address of the complainant, 6. the actual complaint, 7. type equipment being interfered with including the antenna system, 8. your findings at the home of the compainant before and after any equipment changes or adjustments, 9. your recommendations.

For your visit, bring along several pieces of test equipment (each will be named as needed in your investigation), and a member of your committee. First, both of you should make a careful inspection of the alleged offending equipment and its operation by the owner, but make no changes nor adjustments at this time. Continue notations in your report. You will need two walkie-talkie transceivers, either CB or hamtype to communicate between your committeeman, who will remain at the ham station for the purpose of relaying your ham transmitting instructions, and you while conducting the interference investigation at the home of the neighbors. Here are three very important points which practically guarantee a satisfactory working relationship between you and the public, 1. unless you know the complainant, go alone (two or more unknown individuals suddenly appearing at the front door, especially at night, will probably get no farther and little cooperation relative to solving the complaint, 2. yours is a business visit, so wear a business suit, (this does several things, it impresses the party that you are somebody, and further that you must know your business, and if clothes make the man, it will give you a sense of self confidence in your dealings and explanations, particularly if you are not well received). Personally, I introduce myself, then my role in the television interference investigation committee, its connection with the local amateur radio club, and finally that I've been asked to make an impartial investigation by the amateur involved in the complaint. Most people are happy to have someone help them with their problem. 3. conduct an impartial investigation. Don't run the ham down to butter up your host, nor run the complainant down to make the ham feel better. For one thing, remember that after your investigation has been completed, you must go back to all parties concerned and review your findings. This job is easy if you were successful in eliminating the trouble, but requires tactful straightforwardness if not. Conduct an efficient and businesslike investigation. The use of walkie-talkies and the committeeman back at the ham station relaying your instructions to the operator help greatly in this and impress your host.



Determine how the interference is getting into the TV set. Disconnect the lead in and move it away and if this is the source, try a Drake type TV-300-HP high pass filter placed and connected electrically as close to the set input as possible (only a few inches) and be sure to connect its case to the TV chassis with a short heavy braid. Check the power line source by inserting a Cornell-Dubilier type IF-18 low pass filter into the line with the same precautions described for the Drake filter. Remember, you are under no obligation to leave either or both units if they eliminate or reduce satisfactorily the interference. They are part of your test equipment group. You may agree to purchase (be sure you know the price!) and install them if paid in advance, or circumstances may dictate staying clear of any involvement in this area. Compare interference results with at least three neighbors in addition to the complainant. Continue to compile results in your report. Even though your investigation shows no interference whatsoever except at the location of the complainant, plan to make electrical tests of the interfering transmitter-antenna system. Experience has shown that some TV sets are bothered by a small malfunction, and even though they may actually be at fault, remember your primary job is to eliminate interference in any way you can.

So, back to the transmitter. If its power line current does not exceed 5 amperes use the C.D. type IF-18 filter to check R.F. leakage through this path. For greater currents you will want to make up a 15 ampere unit in a shielded box as part of your committee equipment. It should be of the balanced type with two 0.1 mf 600 volt feed-through type capacitors from each side of the AC line to the case, two series inductors, and two similar connected capacitors to the case again. Each group should be in its own shielded compartment. Use No. 12 enamel wire, wound for a length of about six inches on an approximately one inch diameter non-metallic form for each coil. Install either filter in the transmitter power line as previously described for the TV set. Check the transmitter earth ground system. It should have one and it should be an effective one, with large diameter bus or braid running to several copper stakes (or tubing) driven deep enough to insure contact with permanently moist earth. Watch out for ground systems that have a length that is harmonically related to the operating frequency. The result can be a high value of R.F. on the ground line and subsequent trouble. Try changing its length. To check interference through the antenna system, load the transmitter into a proper size light bulb. Three sizes will take care of this requirement, 25, 150, 500 watts. If the trouble disappears, use the inductance in the station matchbox to check for harmonic radiation with your grid dip meter (non-oscillating condition) which should be capable of operating up to at least 200 Mcs. If a matchbox is not used, install yours (another piece of test equipment) to make the check, and also test for TVI at this time. Possibly only your unit is all that is needed to clear up the trouble. Look for loose coax connectors and poor grounding of the coax braid to the connectors. Check the VSWR of the antenna system with your wide range R.F. oscillator (more test equipment). If it is above 2.5 or 3 to 1, look for trouble here. Correcting it may eliminate the problem. A length of your own same type coax, preferably a quarter wavelength, when inserted in the regular feedline may show that an original low VSWR is now high, indicating system trouble (mismatch) and that initially you just happened to have the SWR bridge connected in at an impedance close to the line value. For transmitters operating below six meters, try your low pass R.F. filter (more test equipment), which matches the coax impedance and has sufficient power capability such as B. & W. types 425 and 426 (50 and 75 ohms respectively). It should be the last component in the feedline (that is, nearest the antenna). Where applicable, check a phone transmitter for modulation percentage and proper waveform appearance. Use your receiver with the last I.F. stage coupled through approximately 25 pf to your wide band oscilloscope.



For the first investigation summary, let's assume that you were successful in locating the trouble and solving it to the satisfaction of everyone. Your review is easy in this case. Complete your report and file it. Each case makes future investigations easier to solve.

For the second summary, let's assume you were again successful in locating the trouble but that its solution requires changes or additions (including the purchase of something such as filter) to the TV set because it is the only one in the neighborhood subject to interference The problem you now face is in direct proportion to the opposition of the complainant to buy something for a set, which to him is receiving TV signals satisfactorily In your explanation you must first put yourself into his non-technical position, then simultaneously point out the results of the investigation which shows that because no other local set shows signs of interference, the ham transmissions are clean and his set alone has an inability to discriminate against the strong local (ham) signal operating on a frequency far removed from the TV channels.

For the third summary, your investigation shows one or more things actually wrong, or in poor practice at the ham station. Usually this results in interference to a number of neighbors. Nearly always, the operator will be only too glad to cooperate and make any changes you recommend to get out of trouble. If you ever do encounter resistance to recommendations, you can only point out that you can no longer support him against the neighborhood, and while you won't "tattle" his non-cooperative attitude, you must report that your hands are tied in solving the problem at that location. You can point out to the ham that at least one neighbor will probably complain to the FCC. Since most club TVI committees are known to the local office, you will receive a complaint review form to complete, and if your report shows non-cooperation, that ham will have two strikes against him initially if the FCC steps into the case.

For the fourth summary, your investigation shows nothing wrong at the ham station, but he is getting into one TV set badly which is connected into a community cable system, with other sets either having only slight interference or none at all. Obviously the trouble here is that sufficient R.F. signal is leaking into the system to show up on a malfunctioning TV set. Explain the situation to the company who, because they are concerned about protecting their system reputation, will probably be very quick to put a test TV set into the home of the complainant just long enough to show that his set alone is subject to interference. If you find several TV sets that are being interfered with (again, proper ham station operation), the community system probably is not operating correctly (examples, mismatched lines or/and loads, poor grounds, malfunctioning amplifier-distribution boxes, etc) and a report should be given to the company for their investigation, and to the local FCC office for their files if the situation warrants it.

An example of reverse interference (to the amateur) is wide band noise (buzz, hum, crackle, etc) heard in the communications receiver as a result of a faulty power system. The cause may be a bad transformer, intermittant line connection, power leakage, etc. Noise can travel great distances from its source which makes its detection very difficult, since you must work on the ground. However, by using a portable receiver or your car set to cover a wide area to determine generally the extent and probable source of noise, and then using the portable set on foot, you probably will find the source location. The more complete your investigation is, the more effective you will be in your contact with the power company. Do not waste your time by going to the front office and filling out some form which starts with an office girl. Go to the Service Department and review your case with the supervisor, making sure you leave a copy of your investigation for his use.

So, enlist and serve as your area TVI committee. Once you learn the ropes by solving a few interference cases, you really will enjoy contributing to the benefit of hams and public alike. . . . WA6OQP

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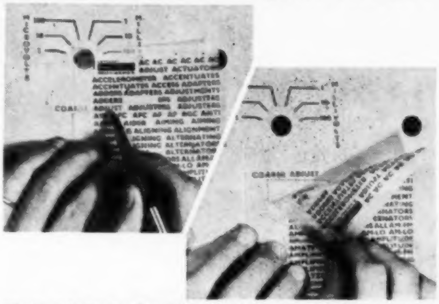

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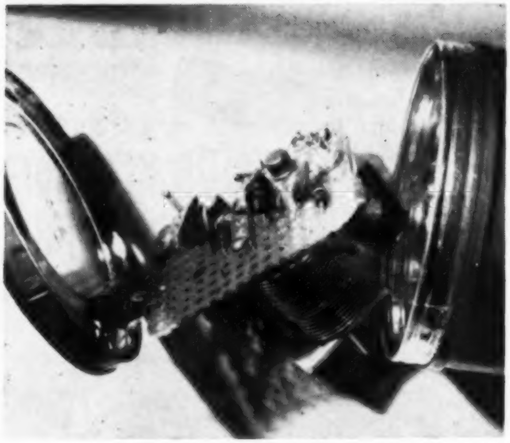


Harley Gabrielson W6HEK
Robert Tellefsen W7SMC/6
277B Tyrella
Mountain View, Calif.

A Coffee-Can VXO for Oscar III

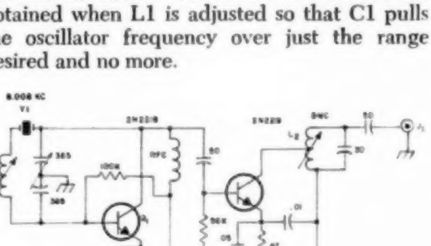
When OSCAR III goes into orbit, a great many hams will be trying to communicate within the 50-kc passband of the satellite translator. Some form of VFO will be just as necessary for operation here as on 20 meters.

With this need in mind, an 8 mc VXO (variable-frequency crystal oscillator) was constructed for use with a Heath VHF-1 Seneca 6 and 2-meter transmitter. It produces ample drive to the transmitter, it is extremely stable, and the 50-kc band occupies about 90 per cent of the 100-division dial used.

The schematic diagram is pretty much self-explanatory, but a few things should be pointed out. The transistors used here were 2N2219's, but any good 30 mc or better transistor can be used. Variable capacitor C1 need not have sections of equal value, nor need the values be as much as the 365 mmfd used here. A plain broadcast variable with unequal sections was used in this unit, with the smaller capacity section connected to the collector of Q1.

The input frequency range of the translator is 144.075 mc to 144.125 mc, so the crystal frequency must be one-eighteenth of this. The VXO circuit pulls the oscillator frequency lower, so when allowance is made for the effect of circuit capacitance, an 8.008-mc crystal is just about perfect. At this frequency it is not difficult to pull the crystal oscillator the needed 4 or 5 kilocycles.

Coil L1, in series with the crystal, determines how far the dual capacitor C1 will pull the oscillator frequency. It must have a high Q and be self resonant higher than the crystal frequency. As the inductance of L1 is increased beyond a certain amount, the crystal will lose control and the oscillator will become an inferior VFO. The best results are obtained when L1 is adjusted so that C1 pulls the oscillator frequency over just the range desired and no more.



Oscar III VXO

Coil Data

L_1 20-25 μh
L_2 Resonate at 8 mc. Tap 1/3 up.
RFC Small 50 ma rfc.

The buffer-amplifier stage, Q2, is coupled to the collector of Q1 through a 50-mmfd capacitor. The smallest capacitance consistent with adequate output should be used. Transistor Q2 derives its operating bias by rectifying rf drive from Q1. When the collector circuit of Q2 is resonated, approximately 10 volts of rf should be obtained.

The VXO was constructed on a scrap of

perforated Fiberglas board, which was then mounted on the rear of variable-capacitor C1. A hole was drilled in the bottom of a half-pound coffee can for the shaft of C1. Three other holes were drilled to permit mounting C1 directly to the bottom of the can. When the can is laid on its side, the bottom becomes the front panel of the VXO. The rf output connector and the feed-through capacitor for the dc input are mounted on the can lid and connected to the circuit by short flexible leads. An additional hole was drilled in the lid to permit adjustment of L1 while the lid is in place.

Before adjusting the VXO, connect its output through a short piece of coax to the input of the transmitter. This is necessary because of the effect of the coax capacity on the output coil L2. Calibrate the VXO by fully meshing the plates of C1 and adjusting L1 to produce a two-meter output at 144.075 mc. When C1 is unmeshed, the frequency should be about 144.130 mc. Set C1 to the middle of its range, and peak output coil L2 for maximum drive to the transmitter.

On-the-air checks with this VXO show its stability to be equal to a regular crystal oscillator.

. . . W6HEK, W7SMC/6

Transistor, Hi, Hi

A 100 yen cab ride from the Tokyo station gets you to a radio row that will stand up against anything in Chicago or New York: Akihabara. There are rows and rows of open air stalls, each stall a "store", and each merchant a specialist. One sells electrolytics, another disc ceramics, another ½ watt resistors—and so on down through all the parts. There's even a knob man! Mechanical filters sell for Y 4,950 (360 yen equal one dollar). Transistor transformers go for Y 140. There is a small semantic problem, however. I don't speak Japanese and most of them don't speak English. Hi means "yes" not "hello" there. Finding out where the nearest jon is turns into a major exercise in sign language. To communicate your desire for a transistor good for a couple of watts at two meters requires more than sign language. To that end data on Japanese transistors useful at VHF was gathered.

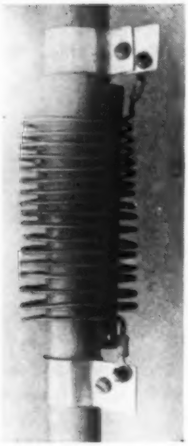
The data should be of some use to the amateur population. Japanese transistors are of good quality and, because of their price, are appearing in more and more equipment. No voltage polarities are given because this is defined in each transistor's numerical identity. The "A" in 2SA213 stands for PNP. The "C" in 2SC38 tells us it is an NPN transistor. The parameters given can be assumed to be max at the specified temperature and without heat sink. The current price is included in the last column not because either Wayne or I have a financial interest in the Japanese transistor market but because the amateur usually buys transistors by a simple equation: most power input at highest alpha cut-off at lowest price . . . And, it's helpful to know ahead of time how far down in the pocket you'll have to dig to replace one.

. . . K6QKL

No.	V_{cb}	I_c (ma)	V_{eb}	P_c (mw)	T_j °C	F_{ab} (mc)	PRICE (YEN)
2SA24	30	10	0.5	60	70	100	-
2SA25	25	15	0.5	50	70	100	-
2SA57	18	5	0.5	55	75	85	270
2SA58	18	5	0.5	55	75	75	260
2SA61	20	10	0.5	100	75	70	-
2SA68	20	10	0.5	100	75	70	-
2SA69	20	10	0.5	83	75	70	500
2SA70	20	10	0.5	100	75	70	600
2SA71	20	5	0.5	100	75	100	700
2SA76	18	5	0.5	55	75	130	570
2SA77	18	5	0.5	55	75	110	540
2SA87	30	10	0.5	80	85	100	-
2SA90	30	20	0.5	200	85	100	-
2SA116	30	10	0.5	80	85	120	-
2SA117	30	10	0.5	80	85	110	-
2SA118	30	10	0.5	80	85	100	-
2SA123	15	2	0.05	15	65	100	900
2SA134	20	10	0.5	80	85	140	-
2SA135	20	10	0.5	80	85	150	-
2SA213	15	2	0.5	15	65	140	-
2SA234	20	10	0.5	80	85	110	-
2SA235	20	10	0.5	80	85	125	500
2SA238	25	30	1	200	85	700	3900
2SA241	20	5	0.4	50	75	200	1200
2SA242	20	5	0.4	50	75	250	1500
2SA243	20	5	0.4	50	75	300	1700
2SA244	25	30	0.5	200	85	600	1300
2SA245	25	30	0.8	200	85	700	1400
2SA246	30	30	0.5	100	85	175	500
2SA247	10	30	1.2	100	85	200	-
2SA253	20	30	1.2	200	85	450	-
2SA288	20	10	0.5	80	85	500	1400
2SA289	20	10	0.5	80	85	600	3900
2SA290	20	10	0.5	80	85	700	4680
2SA308	20	5	0.3	50	75	450	4000
2SA309	20	5	0.3	50	75	600	5800
2SA310	32	25	0.3	100	75	450	7000
2SA316	18	20	0.5	60	75	75	350
2SC15	30	50	5	750	175	180	2400
2SC25	60	60	3	500	150	70	900
2SC26	60	100	5	500	150	250	-
2SC28	40	50	5	225	150	100	-
2SC29	40	25	5	115	150	100	-
2SC31	60	80	5	1.5W	150	230	860
2SC32	60	80	5	1.5W	150	280	1150
2SC33	45	50	3	150	150	270	4600
2SC38	40	80	8	500	150	200	540
2SC49	120	300	10	800	175	160	8600
2SC150	20	100	1	750	175	100	2570
2SC151	40	100	4	750	175	130	2900
2SC152	60	100	4	750	175	160	5100
2SC160	20	20	1	125	150	100	2420

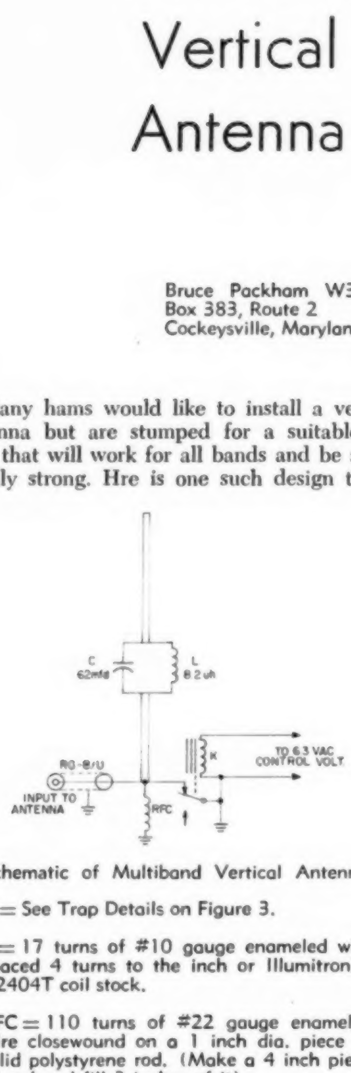
Multiband Vertical Antenna

Bruce Packham W3UWV
Box 383, Route 2
Cockeysville, Maryland



Closeup of trap construction, in particular the mounting of the inductor.

Many hams would like to install a vertical antenna but are stumped for a suitable design that will work for all bands and be structurally strong. Hre is one such design that I have found very successful on both counts.



Schematic of Multiband Vertical Antenna.

C = See Trap Details on Figure 3.

L = 17 turns of #10 gauge enameled wire spaced 4 turns to the inch or Illumitronics #2404T coil stock.

RFC = 110 turns of #22 gauge enameled wire closewound on a 1 inch dia. piece of solid polystyrene rod. (Make a 4 inch piece of rod and fill 3 inches of it).

K = Potter-Brumfield type PR5AY with a 6 volt AC coil—SPDT contacts.

The all band problem can be solved a number of ways, but after trying several, I decided to use a trap design. Two diameters of the antenna tubing were used for the plates of the capacitor and the inductance is supported surrounding the tubing as shown in the photograph of the trap. The trap was designed by covering cardboard tubing of the size of the aluminum tubing with aluminum foil wrap. Thus the trap was designed in the comfort of my basement long before the procurement of aluminum tubing. If you are designing a tubing capacitor where the lengths are long, you may wish to try this idea. It will also save you from chopping off a short length of your precious tubing just to experiment with.

The schematic of the antenna is shown in Fig. 1. The trap is resonant at 7.1 mc. Because the impedance of a parallel tuned circuit is infinite at resonance, the trap serves to disconnect the portion of the antenna above the trap from the portion below the trap at 7.1 mc (40 meters). The mechanical length of the lower section is not a classic ¼ wave length long at 40 meters because the effective diameter of the antenna approaches that of a 5 inch diameter cylinder. The capacitance of such a body with respect to earth greatly reduces the mechanical length required to obtain the desired electrical length.

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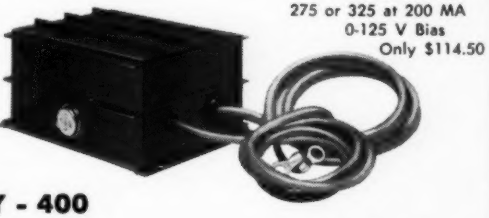

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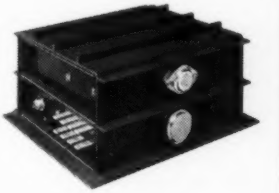

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On 80 meters the trap is inductive and this inductance plus the total length of the antenna serve as a ¼ wave radiator. On 20 meters and above, the trap is capacitive in character and therefore shortens the electrical length of the antenna. The feed impedance varies from 22 ohms to 196 ohms and RG-8/U was selected for the feed line.

The VSWR on 40, 20, 15 and 10 meters is less than 2 to 1 across each of the bands. On 80 meters we run into the perennial problem of bandwidth with small diameter radiators. It is impossible to cover more than about 75 kc and remain below 2 to 1 on VSWR. When we tune the antenna we will set up the radiator length for the desired portion of 80 meters and let the other bands "fall where they may". The VSWR on 80 meters will be about 3.8 to 1 over the entire band and less than 2 to 1 over the 70 to 80 kc bandwidth just mentioned.

Note the rf choke from the base of the antenna to ground. This choke bleeds off electrostatic charges and therefore reduces the possibility of damage to radio equipment connected to the radiator. It is wound on a piece of 1 inch solid polystryrene rod and mounted at the base of the antenna. It is connected to the antenna and ground with copper braid made from the braided shield of RG-58/U coax.

The grounding relay is wired in fail-safe fashion to ground the antenna when it is not in use. This relay is mounted inside a 3 × 4 × 5 inch Mini-Box and mounted at the base of the antenna. Copper braid is used to connect the relay from ground to antenna. The box can be easily waterproofed by sealing all seams with liquid rubber. This liquid rubber is obtainable in any dime or hardware store.

The antenna ground system consists of seven radials of aluminum stranded wire buried about 6 inches beneath the earth's surface. A sod edger shovel can be used to slice a slot in the ground. The aluminum wire should then be laid in the slot and the earth tamped shut. The result will be no scars to your lawn from the installation. Each of the aluminum ground radials should be clamped to an aluminum pipe driven 3 feet into the ground at a distance of 6 inches from the base of the antenna. The use of an aluminum strap prevents problems from dissimilar metals when clamping the radials. No spray coat or preservative was used on this ground radial connection in my installation, but an application of liquid rubber over the entire joint would probably make a more workmanship job.

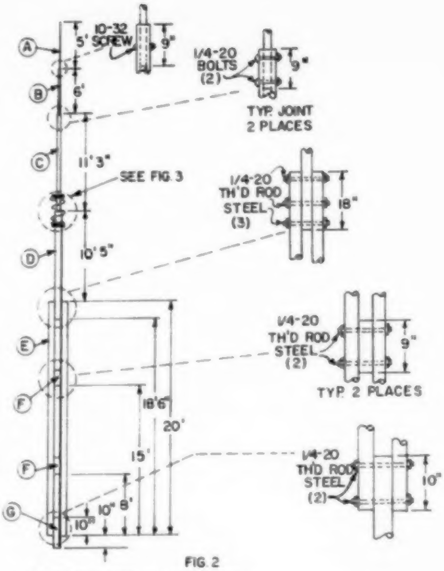

FIG. 2

Construction of antenna.

TUBING LEGEND - See Figure 2

A	1/4 inch O. D.
B	1/2 inch O. D.
C	1-1/2 inch O. D.
D	2 inch O. D.
E	2 inch O. D.
F	2 inch O. D.
G	2 inch O. D.

NOTE: All tubing is 2024S-T4 aluminum with .043 wall thickness.

While in my installation it was not possible to lay radials about the entire 360° of the base because of the house, I have not noticed any bad effects on the radiation pattern. The lengths of my radials are as long as possible, but in no case longer than 40 feet. The purpose of the radials is to establish a good ground system, so if you can install more radials than this and make them longer, by all means do so. A practical limit would be 13 or 14 radials of 70 feet length.

As for the antenna itself, I used some unused sections of aluminum tower for the lower portion. If you don't have some tower sections handy, don't despair. The design shown for the lower section (see Fig. 2) is much stronger than required, is cheaper by far, much lighter and offers a lot less wind resistance than mine! I used the tower sections for three reasons: (1) I had them. (2) I wanted to use them for something and (3) my mind was blocked concerning a simpler and more effective lower section design.

If you use the more practical design shown in Fig. 2, you should note the use of spacer tubes between the two main vertical mumbers of the lowest section. These connections are important as they serve to distribute the loads evenly among the two vertical members.

The base of my lower section is mounted on six 1¾ inch high ceramic honeycomb stand-off insulators. Since the load on these insulators is both compression and shear, they are of good quality. The insulators are screw-fastened to a fir wood block which, in turn, is secured to a one cubic foot block of concrete in the earth. For the design shown, an excellent insulator would be a large 1 quart soft drink bottle. To install this bottle insulator, the bottle should be coated generously with petroleum jelly. After digging a 1 foot cubic hole in the ground, place the bottle on a brick in the hole. Pour cement into the hole and around the bottle. When the cement is just about firm, *carefully* rotate the bottle to free it slightly from the concrete. When the cement is hard, you will be able to remove the insulator should it ever need replacing. As a safety feature, you should insert a steel or aluminum rod inside the bottle. The length should be such that it extends up into within ¼ inch of the lip. With this rod in place, the foot of the antenna cannot slip out should the insulator ever break.

The structural details of the trap are shown in Fig. 3. Notice the hole through the center line of the trap insulator. This hole prevents water from lodging in the antenna and also prevents split tubing in climates where the water would freeze. The insulator is phenolic resin reinforced cloth and is obtainable from many plastics supply houses. I would guess that seasoned white oak could also be used if it were first coated with transformer varnish or boiled in wax for 3 or 4 hours. A high school wood shop or a friend can usually be counted on to perform the simple lathe work required if you don't have one . . . (I don't).

After machining the plastic insulator it should be placed inside the smaller diameter tubing. Using a number 41 drill, drill about 10 or 12 holes in the tubing and into the insulator to at least ½ inch depth. Remove the

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7001KC to 10,000KC (Fund. Freq.)	3.25 ea.
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insulator and tap each of these holes with a 4-40 tap. Drill out each of the holes in the aluminum tubing with a number 32 drill to clear a 4-40 cadmium or nickel plated machine screw. Reinsert the insulator and fasten it to the tubing with one or two ⅜ inch long screws, lightly. With a ¼ inch drill, drill a hole all the way through the diameter of the aluminum tube and insulator in two places as shown in Fig. 3. Remove the insulator and, using a ⅜ inch drill, enlarge the ¼ inch holes in the aluminum tubing only. Assemble the insulator inside the smaller tubing permanently with 4-40 screws ⅜ inches long. We're just about finished with the trap.

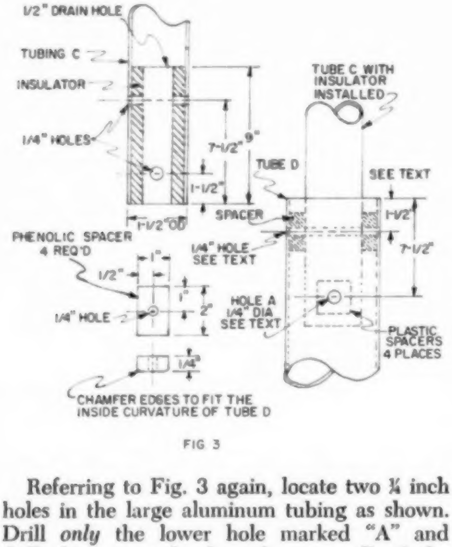

FIG 3

Referring to Fig. 3 again, locate two ¼ inch holes in the large aluminum tubing as shown. Drill *only* the lower hole marked "A" and drill this one *only* through one wall of the tube. Now place the smaller tube inside the larger tube and when the lower holes of each are lined up across the diameter, drill a ¼ inch hole through the other wall of the large tube using the ¼ hole in the insulator as a guide. Remove the drill and place a ¼ inch machine bolt into this hole. Measure the location of the other through the hole in the insulator from the lip of the large tube. After carefully locating this position on the outside of the large tube, drill a hole through the large tube, through the insulator hole already drilled and through the far wall of the large tube. Remove the ¼ inch machine screw and pull the small tube out. Clean up the burrs on the inside of the large tube.

Make 4 spacers as detailed in Fig. 3. Fasten these to the outside of the small tube with *one layer* of plastic electrical tape. These spacers must be in line with the through holes of the insulator.

Carefully re-insert the small tube inside the larger tube and place ¼ inch cadmium or nickel plated machine bolts through the assembly. We now have a joint which is mechanically strong and electrically forms a capacitance between the large and small tubing.

My coil was wound with #10 wire and supported with aluminum straps around the large and small tubing as shown in the photographs of the trap. The wire was prevented from shorting against its neighboring turns by means of a split insulator made from 2 strips of plastic. The two strips were clamped together and a hole for each turn drilled through the parting line. All this trouble can be avoided by using ready made coil stock. Use Illumitronic Engineering #2404T coil stock material.

The antenna could be guyed from the top of the lower section, but I chose to mount mine on the side of the house. By using 2024S-T4 aluminum tubing of 0.043 wall thickness, the antenna is very light and yet doesn't require any support other than at the base and a bracket to the house about 8 feet up from the base. A "W" shaped mounting bracket was constructed of 2 x 3 inch fir and was painted with redwood stain so that it would blend into the color of the brick of my home.

Tune up of the antenna can best be done by means of an impedance bridge[1] and rf signal generator. Specifically, I used an antenna scope[2] and Heathkit rf signal generator. How anyone who constructs and adjusts antennas can operate without such a device is beyond me. If you don't have one, now is an ideal time to remedy the situation.

Connect the impedance bridge between the antenna and the ground post. Adjust the output of the generator driving the bridge until the bridge null meter reads about ½ to ¾ full scale. By rotating the frequency dial of the generator appropriately, all the dips of resonance will be found on the bridge null meter. Lengthen or shorten the uppermost length of the tube to obtain resonance at the desired point on 80 meters. Check the other resonant points again. They probably have shifted but you will still find a 2 to 1 or better VSWR across each of the bands. The antenna is fed with RG-8/U at the bottom of the base.

Thus far, the antenna has withstood winds and gusts to 60 mph. Because of the nature of 2024S-T4 aluminum, the antenna literally springs back to shape after such a blow. Good luck and happy DX hunting!

. . . W3UWV

---

1. Radio Amateur's Handbook.
2. C.Q., June and July 1954.

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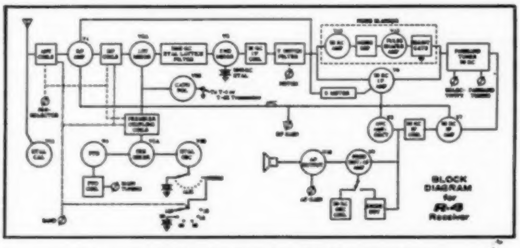
- **Receives SSB, AM, CW, and RTTY** with full RF gain, complete AVC action and accurate S-meter indication.
- **Product detector** for SSB/CW—diode detector for AM.
- **Excellent overload and cross modulation characteristics;** insensitive to operation of nearby transmitters.
- **Compact size; rugged construction.**
- **Transceive capability;** May be used to transceive with the T-4 "Reciter" or T-4X Transmitter.
- **13 tubes and 7 diodes.**



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SPECIFICATIONS— Model R-4

FREQUENCY COVERAGE: 3.5-4.0 Mc, 7.0-7.5 Mc, 14.0-14.5, 21.0-21.5, and 28.5-29.0 Mc with crystals supplied. Ten accessory crystal sockets are provided for coverage of any 10 additional 500 KC ranges between 1.5 and 30 Mc with the exception of 5.0-6.0 Mc.

SELECTIVITY: Drake tunable passband filter provides:
.4 KC at 6 DB down and 2.6 KC at 60 DB down
1.2 KC at 6 DB down and 4.8 KC at 60 DB down
2.4 KC at 6 DB down and 8.2 KC at 60 DB down
4.8 KC at 6 DB down and 25 KC at 60 DB down
Selectivity switching is independent of detector and AVC switching.

I.F. FREQUENCIES: First I.F.—5645 KC crystal lattice filter; second I.F.—50 KC tunable L/C filter.

STABILITY: Less than 100 cycles after warm up. Less than 100 cycles for 10% line voltage change.

SENSITIVITY: Less than ½ uv for 10 DB signal plus noise to noise on all amateur bands.

MODES OF OPERATION: SSB, CW, AM, RTTY.

DIAL CALIBRATION: Main dial calibrated 0 to 500 KC and 500 to 1000 KC in 5 KC divisions. Vernier dial calibrated 0 to 25 KC in 1 KC divisions.

CALIBRATION ACCURACY: Better than 1 KC when calibrated at nearest 100 KC point.

AVC: Amplified delayed AVC having slow (.75 sec.) or fast (.025 sec.) discharge; less than 100 microsecond charge. AVC can also be switched off. 3 DB change in AF output with 60 DB change in RF input.

AUDIO OUTPUT: 1.4 watts max. and .5 watts at AVC threshold.

AUDIO OUTPUT IMPEDANCE: 4 Ohms and hi impedance for anti-vox.

ANTENNA INPUT: Nominal 52 Ohms.

SPURIOUS RESPONSES: Image rejection more than 60 DB. I.F. rejection more than 60 DB on ham ranges. Internal spurious responses in ham ranges less than the equivalent 1 uv signal on the antenna.

FRONT PANEL CONTROLS: Main tuning, AF gain, RF gain, AM-SSB/CW with slow AVC, fast AVC, or AVC off, function switch, band switch, xtal switch, passband tuning and selectivity, preselector, notch, and headphone jack.

REAR CHASSIS JACKS AND CONTROLS: S-meter zero, notch adjust, antenna jack, speaker jack, mute jack, anti-vox jack, accessory power socket, and fuse post.

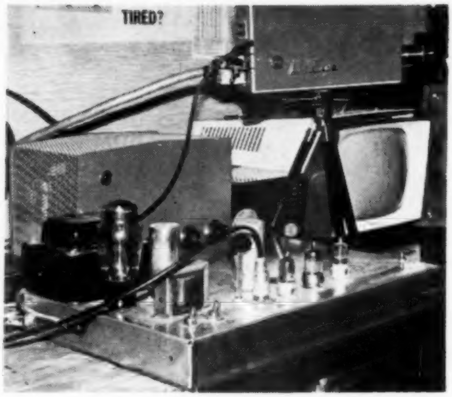
POWER CONSUMPTION: 50 watts, 120/240 VAC, 50/60 cycles.

DIMENSIONS: 5½" high, 10¾" wide, cabinet depth 11⅝", overall length 12¼", weight 16 lbs.

AVAILABLE ACCESSORY: Model MS-4 matching speaker cabinet with high efficiency 5 x 7 speaker. Cabinet also houses the power supply for the T-4 or T-4X matching transmitters.

Practical details in getting on the air.

Let's Go Ham TV



Eugene Mitchell K3DSM
352 Woodley Rd.
Merion Stn., Pa.

Experimenting with ham TV is much more fun and interesting than working with any other phase of communications. It's not really expensive when you compare it to most of the sideband equipment presently on the market. And besides, it makes possible some of the most unique eyeball QSO's that you will ever experience!

The knowledge required to operate a ham TV rig is very little compared to what you would have to know to operate a commercial TV station. If you can tune up and operate an SSB transmitter, you can make the few adjustments necessary to operate television. You can even build a camera without too much technical knowledge.

Basic to all television systems is the electron beam which sweeps back and forth across the pickup tube of the camera and the viewing screen of the television receiver. This is very similar to the way that you read a book. The camera and receiver are both syncronized so that the beam is always at the same place on both the sending and receiving ends. In the camera, the electron beam converts the optical image into an equivalent electrical signal which is used to modulate the electron beam in the picture tube at the distant receiving point . . . thus reproducing the original scene.

One of the cheaper ways of sending a picture is by using slow-scan or FAX. Detailed construction data [*] was written by WA2BCW some years ago. This type of television generally uses a flying spot scanner of special design and can only be used to scan slides and other still type material. Since the scanning rate is so slow compared to regular television, a special receiver incorporating a CR tube with a slow decay must be used. Otherwise, you would only see a line of the picture at a time. By the time the next line is scanned, the former line would be disappearing. Because of the narrow band width, it can be used with any phone modulator, transmitter, and receiver. The scanner connects to the microphone jack, and the receiving picture circuits connect to the audio output of the receiver.

There is no end to the experimentation that can be done with television. Recently, a complete amateur color television system [*] using conventional NTSC standards was built and tested with good results.

Cameras

Not having the time to build a camera or flying spot scanner, I took the easy way out and was able to get the RCA TV EYE, a closed circuit television camera, at a very reasonable price. After months of searching, the RCA camera was obtained for $425. Included with the complete package was the lens and vidicon. With careful hunting you can find many similar bargains. The RCA TV EYE has currently been on a closeout sale from RCA [**] for $495. cash. This is a complete package, except for lens, and includes a new vidicon with warranty.

Sylvania, Argus, Dage, and many others also have similar cameras on the market with prices ranging from $400-$800 and up. These are all capable of picking up live action, slides, and pictures with excellent quality. Denson Electronics of Rockville, Connecticut handles all sorts of television equipment, new and used. Plans and parts for building a complete vidicon camera are available from Denson. It can be built for about $180 complete. The Electron Corp. of Texas has, up 'til a while ago, manufactured a complete station for ham use. Although this line has been discontinued, you can find some of the equipment at some radio distributors if you hunt around. There are also various army surplus cameras on the market ranging in price from $15-$50. They require slight modification but can provide a very cheap way of getting on live television. Conversion details can be found in the May 1957 isuse of CQ.

---

[*] QST, August & Sept. 1958, April 1960, Jan. & Feb. 1961.

[*] QST Sept. 1960.

[**] QST Nov. 1962 (page 35).

Antenna and Receiving Equipment

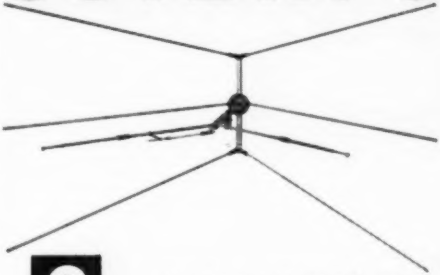
The antenna and receiving equipment are the simplest parts of the whole station. A simple 13 inch folded dipole can be used for *local* communication with good results. I use a 13 element Hy Gain yagi and a UHF corner reflector (standard UHF TV receiving antenna). Both make excellent transmitting and receiving antennas with gains of about 12-15 db. The yagi costs about $13 and the corner reflector costs about $4. The best feedline is the new foam-filled tubular twin lead which costs about $3 for a hundred foot roll. This has very little signal loss and can withstand the weather very well. Coax and standard twin-lead have losses that discourage their use.

For receiving, a simple UHF converter is used on a standard television receiver. Blonder Tongue has two models available for $18 and $28 which will tune down to 441 mc. These are standard models used for standard UHF reception. The *if* output is normally channel 5 or 6. With this output, the converter will tune down to about 460 mc. By using a channel 2 *if* the converter will receive about 441 mc and up. This has one disadvantage. My model BTU2S, even though it has an rf stage, loses its sensitivity when tuned to the channel 2 *if*. The oscillator and *if* trimmers inside of the converter have not been changed because of the excellent reception on regular UHF broadcast. However, if you plan to use your converter only for ATV it is recommended that you pad the oscillator the required amount leaving the *if* on either channel 5 or 6 as recommended by the manufacturer. A homebrew converter using a nuvistor rf stage is on the drawing board. Hopes are this will bring the gain back to normal for ATV operations and still keep the converter normal for regular UHF broadcast reception.

Transmitters

The transmitting parts of the station can be a very simple, inexpensive, low power sys-

COVEYA•6



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- 10 DB gain over ½ wave dipole
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- VSWR at resonance — 1:1 to 1
- Band width — 1000 KC with VSWR under 2 to 1
- Gamma matched for 52 ohm coax feedline
- Adjustable for center frequency, 50 to 54 MC
- Power handling capacity — 1 KW

Model COV-6 **$39.90**

HF-62 MOBILE

1 antenna for 6 and 2 meters

- Tunable for 6 and 2 meter.
- Low SWR.
- 4-section, heavy duty chrome plated brass tubing assembly precision fit to avoid rattling and provide 100% electrical contact.
- Opens to 44", collapses to 22".
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- Stainless steel adjustable tuning rod.
- Includes 5 ft. of detachable RG-58/U coaxial cable with PL-259 connector.

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Model HF-2, Mast only. Has same features as Model HF-62. ⅜-24 stud will fit any standard mobile mount.... **$8.64**

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tem such as hetrodyning the rf from the camera to the UHF band, modulating a single tube parallel bar transmitter, or it can be a more expensive unit running crystal control and much more power. The first method, hetrodyning the camera rf, is very well described by W1CUT in September 1962 QST. Further on in this article, a simple way to put video on the air will be described. This uses a single tube oscillator as the transmitter. A tripler-amplifier for 440 mc is described in the ARRL handbook. When used with a two-meter transmitter, it is capable of putting a good stable 20-40 watts on the air.

TV Bands

Worthy of mention at this time is that the ¾ meter band is divided into three sections by mutual agreement between amateurs. The 420-432 mc section is used for FM and unstable oscillators; 432-436 mc is used for xtal control AM and CW, and 436-450 mc is used for television. Violation of this agreement would be frowned on by your fellow amateurs. Since a video signal can extend as far as 4 to 5 mc from each side of the carrier frequency, operation near band edges must be closely watched. The ¾ meter band is the lowest band that ham TV can be used on because of the bandwidth that a video signal takes up. The slow scan system mentioned earlier uses a bandwidth not much wider than a phone signal and, therefore, is permitted on the lower VHF bands where greater range can be obtained. A request was made some time ago to allow slow-scan on 10 and 15 meters, but was denied by the FCC.

Results of Tests

A few tests have been run with W3HPO, K3DOT, and K3ADS, with negative results thus far. W3HPO uses a homebrew vidicon camera and tripler-amplifier, driven by a 2-meter exciter. He runs about 30-40 watts. Although we live only a few miles apart we haven't yet received each other's signals. This is undoubtedly due to low sensitivity of the receiving converter mentioned earlier. Neighborhood tests with the UHF converter have been very satisfactory. One night, a faint test pattern was observed with call letters W3Z??. One possibility was called to my attention, but it is unconfirmed.

TV Eye Camera Modifications

Two very simple modifications were made to the camera unit. (Fig. 1.) An 8 mf electrolytic capacitor was connected to the plate of the 6U8 modulator (IV3-A). This comes out of the camera via a length of RG-59/U coax. This provides video output without rf. The camera has an oscillator with output on any channel from 2-6 for monitoring purposes with a standard TV set. The video output connects to a modulator shown in Fig. 2. It is possible to feed a monitor with the rf from the camera and, at the same time, run video to the modulator of the 441 mc transmitter. Also, a single pole single throw toggle switch was connected to the ocillator B plus lead in the camera to cut it off when not in use. This is not necessary, but nice to have. The switch was not mounted, nor was the cable supplying video connected to a jack. The wires for both come out through an opening in the back right side where they are connected. It was done this way so they could be removed if later it was decided they were not needed.

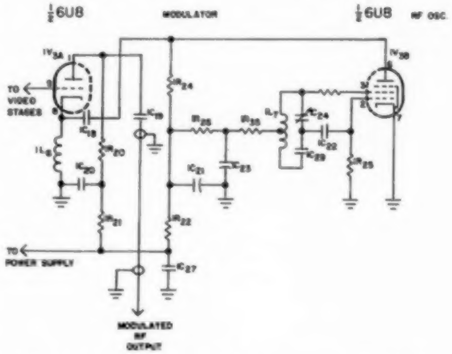
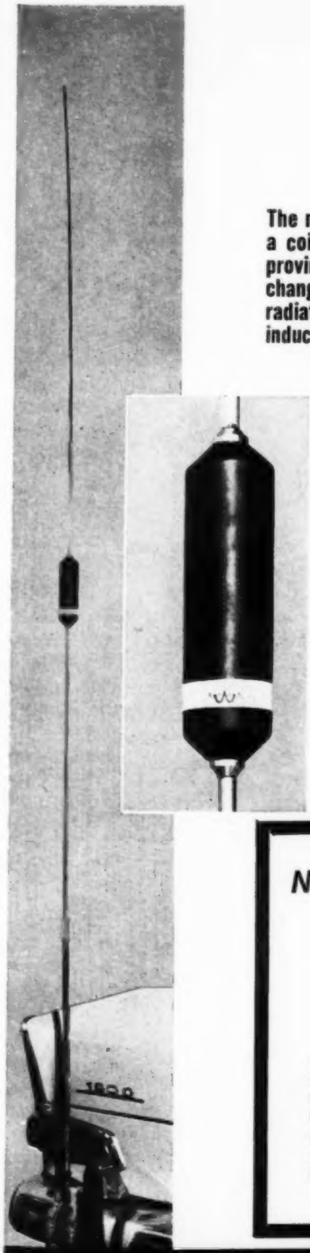


Fig. 1. Portion of RCA camera showing modulator and rf oscillator. Parts are labeled as on the schematic supplied. This is to help in locating the changes.
C1: 8-20mfd 150v electrolytic
To disable oscillator, lift IR24 and IR26 off terminal strip.

Modulator-Xmtr

Many get as far as running closed circuit in the shack, but never get the signal on the air. A very inexpensive video modulator and parallel bar transmitter to put the signal from the camera or flying spot scanner on the air will be described at this time (See Fig. 2.). The rf section is a popular circuit commonly found in UHF transmitters of this type. A similar one is found in the ARRL handbook. The modulator has been designed so it can be used with almost any camera or flying spot scanner having video output. Parts layout is not critical in the video amplifier and modulator. The rf section requires the proper spacing of the plate lines and butterfly capacitor. A large chassis was used so room for expansion would be available. The actual size is left up to the builder.



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Mast 370-1	$12.95	Coil 370-20	$13.45
Radiator Tip 370-2	$ 9.95	Coil 370-15	$12.75
Coil 370-75	$15.95	Coil 370-11	$11.95
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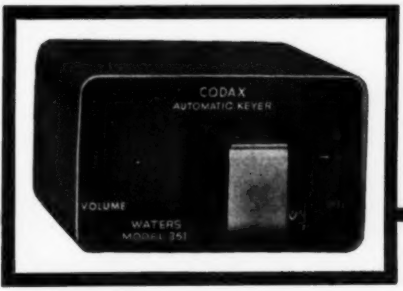

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Video circuits are very similar to the familiar audio circuits. When working with video circuits, consideration of bandwidth is very important. It is very easy to chop off high frequencies necessary to the video signal. The video modulator uses no transformers since they cut off these high frequencies. Modulation is usually applied by one of two methods: capacitor coupling to the grid, cathode, or plate, or connecting the modulator tube in series with the plate or cathode of the final amplifier or transmitting tube. Polarity, the changing of black to white and white to black, of a video signal, can be changed by taking the video off either the plate or cathode of a video stage. It can be changed by adding a single or odd number of video stages. When video amplification is necessary you must add two (or any even number of stages) if you expect to keep the same polarity. This is important since the American system requires that we transmit a "negative" video signal; that is to say, the black areas in the televised picture represent an increase of power while the white represent a decrease of power. Frequency multiplication of rf containing video cannot be done without destroying the picture. This modulator can be used on other transmitters, and, if necessary, additional stages can be added when higher power is used. The video amplifiers and modulators are basically the same as audio amplifiers and modulators. The gain control is adjusted until a good clear picture is visible indicating proper modulation level.

Care must be taken to make sure that you stay within the band. Frequency can be checked with the UHF converter connected to the television set and by using leacher wires coupled to the tank circuit. Use of leacher wires is covered in the ARRL handbook. The transmitter was worked the first time into a dummy load. After frequency was checked, the yagi and corner reflector were tried and frequency rechecked. Changing anything in the antenna circuit changes frequency slightly. Frequency adjustments can be made by turning the butterfly capacitor in the plate lines. Frequency is mainly controlled by the length of the two parallel wires which are ¼ wave-length. Very little drift can be detected in the transmitter.

Switching from transmit to receive requires cutting off the transmitter and changing the antennas if you use one for both transmitting and receiving. Using two antennas is recommended since the corner reflectors are available at reasonable cost, eliminating losses in antenna switching. Either relays or switches can be used for changing from transmit to receive. The receiving converter may be left on for monitoring purposes if the camera rf is not used. Fortunately, we do not experience video feedback.

Power Supply

Since the camera has its own power supply, only power to the video amplifiers, modulator, and transmitter are necessary. The supply shown in the picture uses a full wave rectifier and supplies 250-300 volts at about 150 ma and 6.3 volts for the filaments. A switch is provided for opening the high voltage center tap to cut off the high voltage during standby. The two capacitors on each side of the filter choke are part of a 4 section capacitor. The other two sections are used in the video amplifiers.

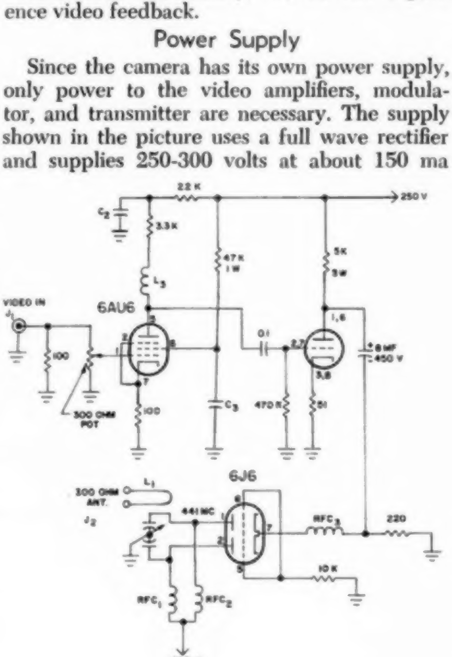

FIG 2

Fig. 2. Modulator-Transmitter schematic.
Unmarked triode modulator is a 12AT7.
C1 5 mmfd butterfly (Johnson #160-203)
C2, C3 20mfd 450v (part of 4 section unit)
L1 3 inches hookup wire
L2 4½ inches #12 spaced ⅜ inch
L3 200 uhy peaking coil
RFC1-5 12 turns #22 enam. wire on 50K
or larger-½ watt Chassis used is 11 x 17
x 4 inches

Audio To Go With Picture

There are several methods to send your voice along with your picture: 1) Use of present lower frequency equipment; 2) Separate FM transmitter operating exactly 4.5 mc above the video carrier frequency. This is the standard separation of video and audio and both can be received on the television receiver; 3) A 4.5 mc sub-carrier fed to the video modulator which will add the audio to the video signal on the same carrier.

When transmitting audio and video at the same time, you must log the transmissions accordingly.

In Conclusion

I have written this article with the hope of interesting more hams to join in on some real fun. After building a TV rig, or even buying one, you want to learn what is going on inside of the equipment. Video theory is not really so complicated.

If you are interested in amateur TV, or if you are already on TV, make yourselves known so we can help each other and swap notes.* There are quite a few on TV looking for schedules. More theory on this subject can be found in the Amateur TV Anthology, published by 73 Magazine.

Being a student in school I haven't had the time I would like to have to experiment with TV. Come vacation though, K3DSM will be buzzing with experiments. Keep a sharp eye out for our CQ-TV!

. . . K3DSM

* One good way to do this and at the same time keep up to date on the latest developments in ATV is to subscribe to ATV EXPERIMENTER. $2.00 per year from 73.

That Professional Touch

Many constructors do not put a top grade finish on their home-brew gear. Most hardwares now carry 'hammer-tone' paint in spray cans, in silver, charcoal black, blue, green and copper. All of these carefully applied from the aerosol cans do a fine professional job of panel finishing.

Black crackle and other black finishes are easy to refinish with Rust-oleum No. 634 Fast Drying Black. Sprayed lightly on dingy black crackle, after washing it with Spic and Span, it results in a display room finish. Trick is to spray very lightly, not enough to mask the texture.

To make the spray paints stick to almost any finish, wash with paint thinner or a good detergent, and dry before painting. Keep it free of finger marks, and allow it to dry a fair period, and a top quality professional finish is available in any shack. (A big help is resisting the impulse to put it all on in one coat, several thin coats work much better.)

. . . Jack Bayha W8BPY

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Solid State SSB Power Supply

At the risk of over-generalization, it can be said that all ham power supplies can be broken down into three types: 1, low power receiver supplies; 2, medium power transmitter supplies; and 3, high power transmitter supplies. The recognized trend today is to "semiconductorize" all three types, sending countless 5Y3's, 5R4's, and 866's to the junkbox. Two further trends of modern amateur radio are A, single sideband, and B, transceiver operation. It follows, therefore, that up-to-date amateurs are combining 1, 2, A, and B, and constructing solid state power supplies for their transceivers. Many transceiver manufacturers, of course, are doing the same. While many hams would hesitate to attempt the construction of a SSB transceiver, $50 or $100 or more can be saved by building at least the power supply, a comparatively simple job.

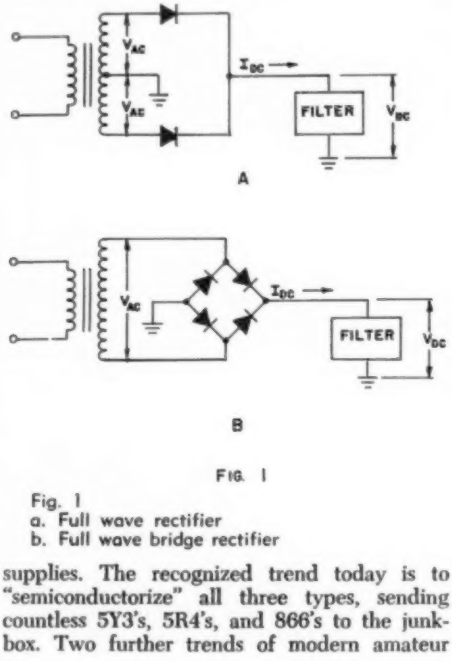

FIG. 1

Fig. 1
a. Full wave rectifier
b. Full wave bridge rectifier

A typical ham's junkbox, (if there is such a thing) may likely contain close to all the components required, keeping the cash outlay to an absolute minimum. Every necessary component is also available on the surplus market at large savings.

The power supply described here was built for the Health HW-12, 22, and 32 single band 200 watt PEP transceivers. The requirements, however, are representative of many on the market. It delivers about 800 vdc at 250 ma peak, 250 vdc at 100 ma −124 vdc for grid bias, and 12.6 vac filament voltage. The bias features zener regulation, and the entire supply has proven very satisfactory in service.

Questions and Answers

Q. My existing power transformer, in a full wave rectifier supply, will only give about half the dc voltage needed for transceiver final. Must I get a new one?

A. Silicon rectifiers lend themselves beauti-

Table 1

	Choke Input Filter		Capacitor Input Filter	
	Full Wave Rect.	Full Wave Bridge	Full Wave Rect.	Full Wave Bridge
PIV	2.8 x vac	1.4 x vac	2.8 x vac	1.4 x vac
Rectifier Current rating	.5 x idc	.5 x idc	.5 x idc	.5 x idc
vac	1.13 x vdc	1.13 x vdc	.85 x vdc	.85 x vdc

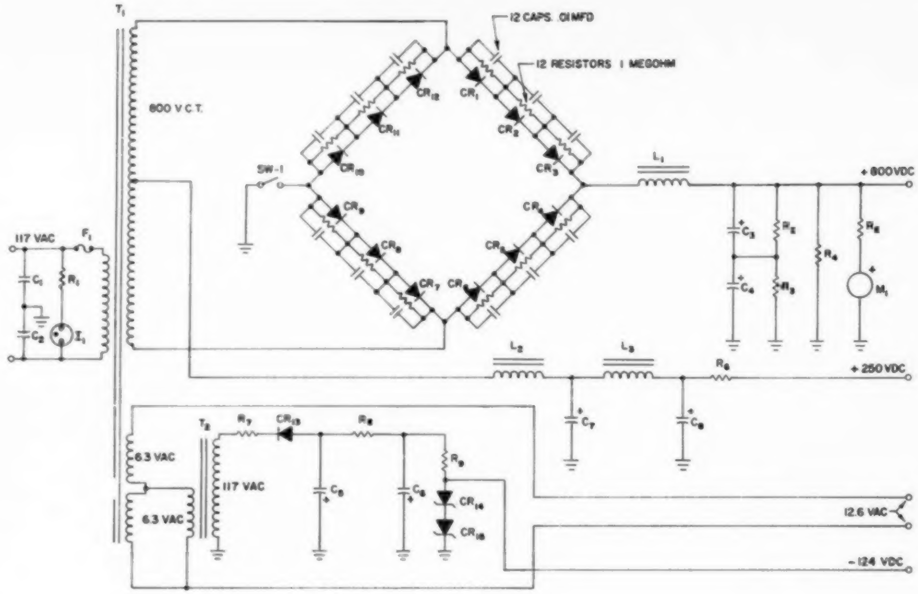

FIG. 2

Fig. 2 Transceiver power supply

Parts List

C1, C2—.001 mfd, 1000 vdc ceramic disc
C3, C4—30 mfd, 500 vdc tubular electrolytic
C5-C8—20 mfd, 450 vdc tubular electrolytic
CR1-CR13—1N547. 600 PIV 750 ma silicon rectifier
CR14, CR15—1N3039. 62 v, 1 w zener diode
F1—4 amp fuse
I1—NE-51 neon indicator lamp
L1—8 h, 250 ma filter choke
L2—8.5 h, 125 ma filter choke
L3—Same as L2
M1—0-1 kv voltmeter, 1 ma movement
R1—270k ½ watt
R2, R3—150k, 2 watt
R4—50k, 25 watt wirewound
R5—1 meg, ±1%, 1 watt
R6—750 ohm, 10 watt wirewound
R7—15 ohm, ½ watt
R8—560 ohm, ½ watt
R9—4.7k, ½ watt
SW1—spst toggle or rotary switch
T1—800 vct 300 ma, 6.3 vac 6 amps, 6.3 vac 6 amps
T2—6.3 vac 1 amp

fully to full wave bridge supplies, since no filament transformers are needed. This will give the required voltage output.

Q. Using a full wave bridge supply for the high voltage, won't I need another transformer for the low voltage receiver and transmitter stages?

A. No. The transformer secondary center tap provides, when filtered, approximately half the DC H. V. output for the low level stages.

Q. Should the bridge supply use a capacitor-input or choke-input filter?

A. While a capacitor-input filter will give a higher output voltage, the choke-input has much better regulation characteristics, and is recommended.

Q. How can I tell what current ratings and peak-inverse voltage (PIV) ratings my silicon rectifiers should have?

A. See Table 1, for both full wave (2 diode) and full wave bridge (4 diode) rectifiers.

Q. Are surge resistors needed in series with the rectifiers?

A. Only with a capacitor-input filter. In a choke-input filter, the inductor itself presents a sufficiently high impedance to protect the diodes. When using surge resistors, remember that at the instant the supply is turned on, the input capacitor has no charge across it. Until it is charged, an abnormally high current is drawn from the supply through the rectifiers. This current must cause a large voltage drop across the surge resistors, to avoid exceeding the rectifier ratings. On the other hand, making them too large will decrease power supply efficiency. 10 or 20 ohms, 1 watt, in series with each leg, is adequate for this type of supply.

Q. Can silicon rectifiers, like capacitors, be wired in series to increase the voltage ratings?

A. Yes, any number can be used in each leg, until the required PIV is reached. The writer is presently planning a 3 KV linear amplifier supply, using strings of 600V PIV rectifiers.

Q. When silicon rectifiers are wired in series, is it necessary to use capacitors and/or resistors across each diode for voltage equalization?

A. Yes. For optimum protection, both should be used. About 0.01 mfd at 600vdc is correct for the diodes used here, shunted by 1 megohm, 1 watt resistors.

Q. Is a large, high-voltage oil filled capacitor better than several tubular electrolytics in series?

A. No. The electrolytics are much less expensive, take up less room, and are no different electrically for this purpose. Use voltage-equalizing resistors across each capacitor, proportional to the voltage ratings.

Q. Won't a bridge supply giving twice the transformer's rated voltage, only give half the rated current?

A. No. Generally, a transformer can deliver at least twice as much peak current as its rated dc value, especially at the low duty cycles usually associated with voice frequencies.

T1, the power transformer, was acquired several years ago as "new surplus." It is rated at 800 vct @ 300 ma dc. The filament windings are rated at 6 amps. The bias transformer, T2, is simply a 6.3 volt filament transformer wired backwards. If this is not available, a 1:1 120v transformer could be used across the ac line. The high voltage portion is a full wave bridge rectifier, using 12 600v PIV silicon rectifiers. It is filtered by a single "L" filter consisting of L1, C3 and C4. R2 and R3 equalize the voltage across the filter capacitors. R4 is a bleeder resistor, and has three functions: it discharges the filter capacitors for safety, it helps to regulate the output voltage, and it keeps the output voltage, when unloaded, from climbing above the capacitor voltage ratings. Because of the quiescent current of the final amplifier, very little bleeder current is required.

M1 is a 1000v voltmeter. A milliammeter in series with the load would have been more typical, but it was desired to monitor voltage regulation rather than load current. It is optional, and either, or both, can be used.

The low voltage, from the transformer center tap, after being well filtered, supplies the receiver section and the low lever transmitter stages. L2 and L3 are also surplus units, and are actually one tapped inductor. R6 is a dropping resistor to obtain the correct output voltage.

The bias voltage is half-wave rectified by CR 13. R7 is a surge resistor, and protects the rectifier. CR 14 and CR 15 are 62 volt, 1 watt zener diodes, giving constant bias voltage regardless of line variations. Very little output current is drawn from the bias supply.

When wiring the filament windings in series, a voltmeter across the output will read either zero volts or 12.6 volts ac. If zero is read, reverse one of the windings, so that they add rather then cancel.

One side of the primary winding is connected through the transceiver function switch to the line, so that the power supply can be switched on with the transceiver. SW 1 is a high/low power switch. Since the power supply is solid state, there are no filaments to warm up, and the full output voltage is at the terminals immediately upon switching on. This is very hard on the transmitter tubes, since their filaments have not yet heated. With SW 1 open, there will be no voltage at the low voltage output, and only half the normal voltage at the high voltage terminals. Full bias, however, will be supplied. After allowing filaments to heat for a minute or so, the switch can be closed, applying full voltage. This should lengthen tube life appreciably. While a SPST toggle switch has worked fine in the writer's supply with no sign of arcing, it may be desired to use a ceramic wafer switch with a higher voltage rating. Of course, the same thing can be done with a time delay relay.

Much wiring can be eliminated, if desired, by purchasing a packaged bridge rectifier unit. These contain the silicon rectifier bridge, with all the required voltage equalizing resistors and capacitors, in a compact potted package with four terminals. One such unit is the Oz Pak, developed for Westinghouse by Ozzie Jaeger, K3OKX.*

This power supply exhibits many advantages over vacuum tube types. The rectifiers run stone cold, there is much less voltage drop across them, they don't require amperes of filament current, they don't shatter when you drop them, and they certainly take up less room. As for price, at least one large surplus house is selling 600 volt PIV units for 36c each. Enough reasons?

. . . W1VIV

---

* Westinghouse Semiconductor Division, Youngwood, Pa.

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SIDEWINDER SPECIFICATIONS:

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Carrier Suppression:	—50 db on SSB
Unwanted Sideband Suppression: VFO or Crystal Control	—40 db
RECEIVER:	
Frequency Stability:	Highly stable incremental tuning utilizes same VFO as transmitter
Sensitivity:	½ µv or better for 10 db $\frac{S+N}{N}$
Selectivity:	Lattice crystal filter for both receiver and transmitter
Spurious Rejection:	—50 db or better
Image Rejection:	—50 db (both receiver and transmitter utilize double conversion)
AMATEUR NET:	$399.50
AC Power Supply	$ 67.75
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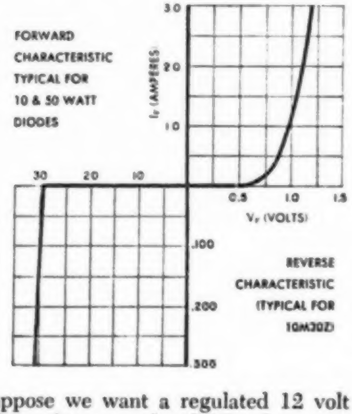
Roger Taylor K9ALD
2811 William St.
Champaign, Ill.

Handy Dandy Zeners

With the advent of transistorized gear, there has developed a need for low voltage regulators. One of the devices used for this purpose is the silicon zener diode. A simplified characteristic curve is shown in Fig. 1. The left hand portion of the curve is the portion we are interested in. Notice that when acting as a zener, the diode is reverse biased, i.e. the positive supply voltage is connected to the cathode. On the curve, current is plotted vertically; voltage is plotted horizontally. Notice that if a voltage in excess of either V_f or V_r is applied across the diode a very large current can flow, thus destroying the diode. For this reason, enough impedance must be connected in series with the diode to limit the current to a safe value.



Suppose we want a regulated 12 volt supply from the unregulated 17 volt output of a rectifier, and the load current varies from zero to 400 milliamperes, (0.4a). Suppose we choose a zener which has its breakdown voltage at 12 volts instead of 30 volts. The voltage across the zener will always be twelve as long as we drop no more than 5 volts across R_s. Now the maximum current the load will draw is 0.4a. The voltage drop across R_s (17-12=5) at 0.4a requires: $R_s = \frac{5}{.4} = 12.5$ ohms. However, in order to have the zener regulating the voltage, we must also supply enough current at 12 volts to be well down on the breakdown portion of the curve. From the graph (Fig. 1), supposing it was 12 volts instead of 30, 100 ma. is well down on the curve. So we will supply the zener with 100 ma. of current. The total current drawn will be 0.4a for the load plus 0.1a for the zener. Thus to drop 5 volts across R_s at a current of 0.5a requires: $R_s = \frac{5}{.5} = 10\Omega$. Isn't that handy? Now at full load the voltage is 12 volts. What happens when we remove the load? We still must draw 0.5a through R_s to stay at 12 volts. Now as the voltage tries to rise, the zener

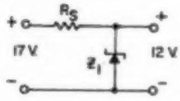


FIG.2

Fig. 2. Basic circuit.

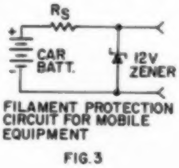


FIG.3

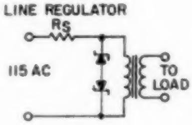


FIG.4

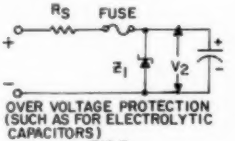

R_S
FUSE
+
Z_1
V_2
+
-
-
OVER VOLTAGE PROTECTION (SUCH AS FOR ELECTROLYTIC CAPACITORS)

FIG.5

Fig. 4 can be used for lowering and regulating the a.c. voltage to a constant load. This protects delicate equipment from line fluctuations.

Fig. 5. When V_2 exceeds the voltage rating of the zener, it draws a large current, causing the fuse to blow. Z_1 must be able to withstand the current surge.

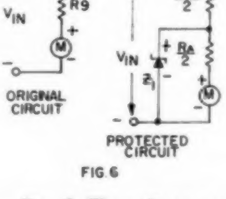


FIG 6

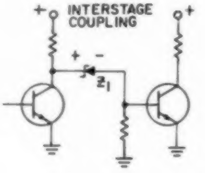


FIG 7

Fig. 6. The voltage across Z_1 cannot exceed the rating of Z_1, thus protecting the meter from excessive current flow, if Vin is too large.

Fig. 7. Since the voltage across Z_1 is constant regardless of the current flow through it, it acts as a very low impedance to an a.c. signal. To a.c. it looks like a large capacitor.

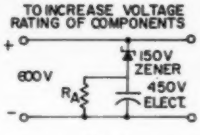

TO INCREASE VOLTAGE RATING OF COMPONENTS
+
150V ZENER
600V
R_A
450V ELECT
-

FIG. 8

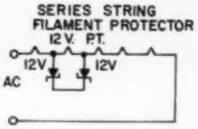

SERIES STRING FILAMENT PROTECTOR
12 V. P.T.
12V
12V
AC

FIG. 9

draws more and more current until the voltage drop across R_s reduces the output to the zener voltage at the current value needed, which is still just about 12 volts. At no load the zener is drawing the full 0.5a needed to hold the voltage at 12 volts. Thus, no matter what the load, within the design limits, the voltage will remain at twelve volts. However, the zener regulates by turning power into *heat*. With twelve volts across it, and 0.5a of current passing through it, the zener is dissipating 6 watts. A ten watt zener can safely dissipate this power if mounted on a *good* heat sink (not just a chassis!!). Notice that the zener can also regulate a varying input. The input can rise to any value, and the zener will still regulate. However care must be taken that the power dissipated does not exceed the ratings. The input voltage can drop until the voltage at the zener terminals drops below 12 volts. In this case: $.4a \times 10\Omega = 4$ volts $12 + 4 = 16$ volts at the input. The number of circuits using zeners is growing constantly. A few of these which might be of interest to hams are shown below.

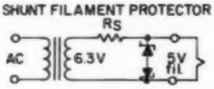

SHUNT FILAMENT PROTECTOR
RS
AC
6.3V
5V FIL

FIG. 10

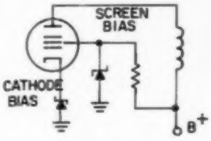

SCREEN BIAS
CATHODE BIAS
B+

FIG. 11

Fig. 11. Zeners can also be used as biasing elements, eliminating the need for bypass capacitors. In addition, the bias voltage is very well regulated.

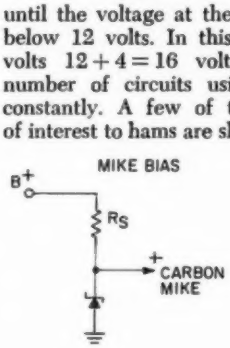

MIKE BIAS
B+
RS
+
CARBON MIKE

FIG. 12

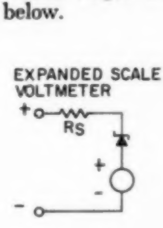

EXPANDED SCALE VOLTMETER
+
RS
+
-
-

FIG. 13

Just think of the zener as a simple battery that you have to put some current into instead of taking it out, and you will probably think of hundreds of additional uses.

. . . K9ALD

good mobiles STILL go go

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Cooling Notes on the 4-1000A

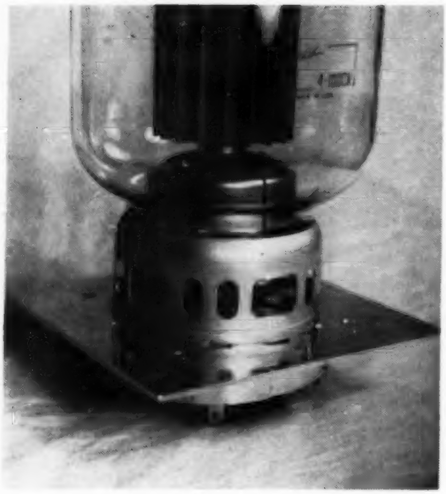

Fig. 4.

Numerous articles have been published concerning the very effective use of the Eimac 4-1000A as an rf linear amplifier, particularly for grounded grid, zero bias class B operation. The purpose of this article is to provide some practical approaches toward the minimization of heat, wasted power, and consequent reduction in the blower noise and requirements for this exceptional tube.

The first consideration was placed upon the filament voltage during standby. In consultation with the Power Grid Division of Eimac, they advised that any reduction in standby voltage will favorably affect the tube life so long as plate current is not being drawn under these conditions. Following this approach, a design change was incorporated using an SPDT relay actuated by the primary voltage of the high voltage power transformer to switch from the normal to a reduced, standby filament voltage in the order of ¾ or less. (Fig. 1) The blower motor may be switched along with the filament primary since the base seal temperature of the tube will now be correspondingly reduced. The results? Less noise, heat, power consumption, and filament thermal shock associated with instant heating at full voltage.

Secondly, it is desirable to eliminate plate current when the plate supply is on and the VOX is open. A very simple 33k five watt wire wound resistor is placed in the filament center tap to ground. In parallel with this resitor is an SPST relay, whose coil is energized through the VOX relay (Fig. 2). This shorts out the self-bias when the VOX relay closes. This system has been in use in the author's amplifier for over three years with excellent results. It also prevents diode noise generation in the amplifier as well. Of course, many other combinations are possible with this relay using additional contacts, such as shorting the receiver input and any other switching frills which one might wish to incorporate.

Thirdly, change an existing Eimac SK 500 socket for their new and improved SK 510. It is a very small investment which will pay off in increased cooling efficiency, thus permitting a further reduction in blower capacity. Unfortunately, the mounting holes do not match in these sockets, but an adaptor plate (Fig. 3) solves this problem or otherwise some re-drilling is necessary on the existing chassis. Because of the plastic body, a low inductance grounding bus was used to return all grounds to a common point at the socket. A word of caution regarding the cooling system. Some operators have lost tubes due to cracked glass in the base caused by failure to adequately cool the tube after all power has been turned off. Here, a time delay relay or other switch-

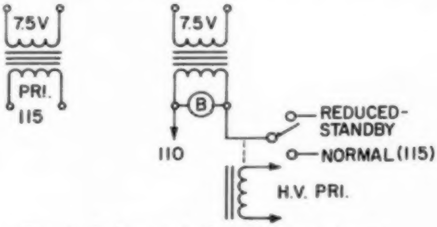

Fig. 1. Before and after filament circuit.

ing will preclude this type of failure by running the blower for 30 seconds to one minute after all plate and filament power have been turned off.

Lastly, as a further means of reducing the back pressure, alternate pairs of holes in the 4-1000A metal base are removed (Fig. 4) with a diagonal cutters. Check the orientation of the holes with respect to the grounding clips for optimum layout. Of course the rough edges should be carefully smoothed with a file after the surgery to eliminate any turbulence. The aluminum or brass is relatively soft and cuts easily. There is still very adequate mechanical strength after this change, and a noticeable improvement in air flow results. However, the limiting consideration of the air flow through the system is the micalex base of the tube which is quite restricted and generates considerable turbulence. The new SK 510 socket assists in this area with 6 points of relief, one at each of the pin connections, and one between pins 1 and 5. This permits some air to flow around the tube base instead of through it and further assists in cooling the plate seal as well as the individual tube pins. A word of caution: use two pairs of pliers if one wishes to bend the lug connectors on the SK 510 as they are brittle at their base. The author broke the first lug in preparation for wiring. Better yet, don't bend the lugs, solder to their base instead.

Regarding forced air requirements, bear in mind that the tube life is related to its operating temperature (C1). Blower noise is usually dependent upon the combination of speed, blade pitch, balance, bearings, motor design, and mounting. In general, these features come only with quality and consequent cost, although the surplus market has been of some help in this area. Eimac specifies that the 4-1000A requires 20 c.f.m. at 0.6 of an inch of pressure for a 1000 watts of continuous plate dissipation up to 30 mcs. with the SK 500 socket. The pressure requirement refers to "the corresponding drop across the socket of 0.6 inch of water column." By most common air requirements for amateur service, this is on the high side with respect to the back pressure, but it was rated with the older, SK 500 socket. Under intermittent duty, such as SSB or CW operation, using the improvements described, one may readily see that the forced air needs were mainly back pressure, and the requirements of the tube are now relatively reasonable for amateur operation. Guesstimating on these bases, it is probable that the blower requirement may now be conservatively rated at 20 c.f.m. at 0.4 inches of pressure.

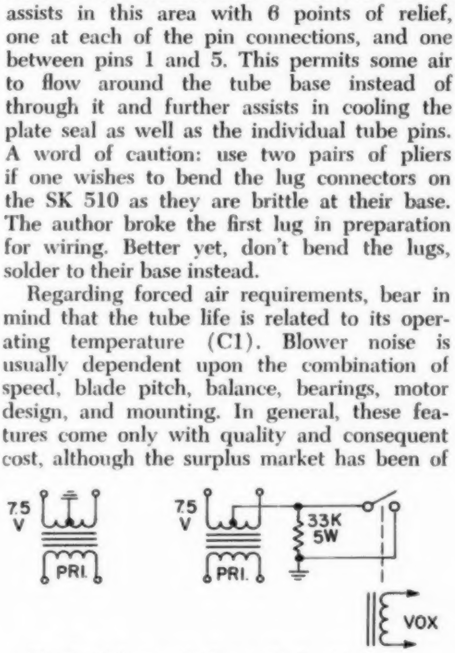

Fig. 2. Before and after cathode circuit.

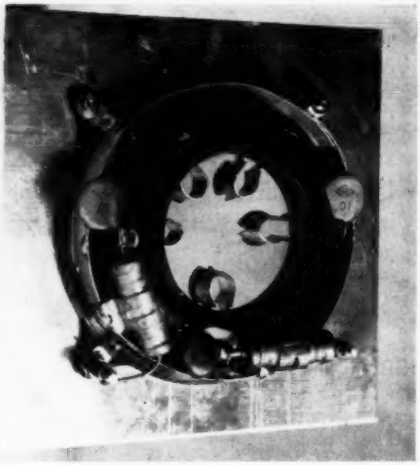

Fig. 3. Mounting plate.

The use of the methods described will tend to increase the tube life while decreasing the wasted heat in the shack. Further, some of the annoying blower noise may be eliminated as a result of the reduced forced air requirements.

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Part II

Last month we presented the construction details and schematic for this transmitter. Now here are step by step instructions for tuning and adjusting it.

Jim Kyle K5JKX
Jim Speck, W5PPE
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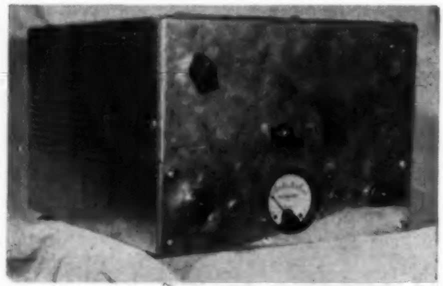
Start by placing "spot-operate" switch on front panel in "spot" position. Connect negative terminal of VTVM to 100K grid-leak of 6EB8 triode stage. Insert crystal between 8 and 8.222 mc in socket. Tune L1 and L4 for maximum VTVM indication.

Then remove power and disconnect 100-ohm resistor in second 6360 B+ circuit from 300-volt line. Connect VTVM negative lead, through Z-144 rf choke, to center-tap of L6. Reapply power, switch "spot-operate" to "operate," and key transmitter. Tune C1 and C3 for maximum voltage. Adjust C2 to improve VTVM reading. We found the setting of C2, incidentally, to be very critical.

Remove power, reconnect resistor, and disconnect power from both screen and plate of second 6360. Move the VTVM lead (with rf choke) to center-tap of L8. Reapply power, key transmitter, and tune C4 and C5 for maximum. Also touch up C3, in case the circuit was detuned by the presence of the VTVM lead.

Remove power, reconnect voltages to screen and plate of 6360, and switch meter switch to Ig position. Key rig and adjust C6 for maximum grid current. At least a mid-scale reading should be obtained, and don't be alarmed if the needle goes completely off-scale. Just reduce the drive with the front-panel drive control and continue tune-up for your peak.



Front-panel controls of the 120-watt 2-meter rig are crystal switch (12-position) at top left; plate tuning above meter; link (output) tuning just to right of plate tuning; meter switch at lower left; and drive control at lower right. Left-hand toggle switch is spot-operate switch, other toggle is transmit-standby for tuneup purposes. Pilot lamp at left of meter completes the lineup.

The second 6360 may require neutralization; ours did. It's accomplished by disconnecting one filament lead from the tube socket and connecting 1½-inch lengths of hookup wire to plate pins 6 and 8. Key the rig and connect an rf VTVM at the output terminals (the built-in rf voltmeter gives a starting point but is not really sensitive enough for the final stages of the job). Adjust the length and position of the wires on pins 6 and 8 for minimum indicated output. We ended up with the wires spaced about ⅜ inch from the grid pins. After neutralization, reconnect the filament lead.

Before completing the final-stage tuneup, the exciter stages should be broad-banded. Use three crystals, one at each extreme of the band segments you want to cover and one near the midpoint. We used an 8000 kc, an 8061, and an 8200, since we wanted to cover the entire band but most operation was to be on either 144.010 or 145.098.

Perform initial tuneup with the midpoint crystal. Plug in the band-edge crystal (either one) and adjust C3 and C5 for maximum drive. With the other band-edge crystal, adjust C1 and C4. Recheck with the midpoint rock. Grid current in the 5894 should be approximately equal with all three. If midpoint is too low, raise it slightly by tuning C1, C3, C4, or C5 slightly. If it's too high, increase coupling between L5 and L6 by bending the two coils slightly closer together. If you have at least mid-scale grid-current reading, however, you really have little need to worry.

Plate tuning is conventional; dip plate current with the dual-15 mmfd capacitor. Output loading is controlled both by position

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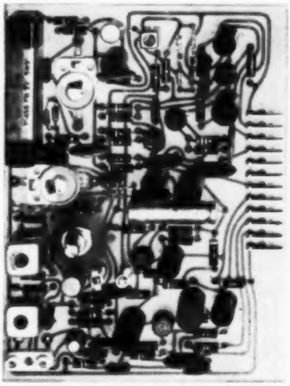

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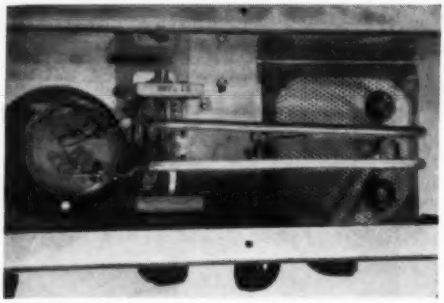

Close-up top view of the 5894 final amplifier.

of the link with respect to the lines, and by tuning of the HF-15X loading capacitor. Adjust both for maximum output indication near the middle of the band and they probably will not need to be touched afterward. Operating Ip reading should not exceed 0.66 (200ma).

With rf tune-up complete it's time to hit the audio. For best results an oscilloscope should be used, but passable adjustment can be accomplished without one.

Three controls are involved in audio tune-up. R1 sets the clipping depth, R2 sets the modulation percentage, and R3 sets the modulator resting plate current They should be adjusted in reverse order.

R3 is easy to adjust. Set the rig for fone operation, turn the meter switch to "mod," and key the mike. Don't talk. Adjust R3 for a meter reading of 0.15. This is equal to 50 ma.

R2 should be set to the high-voltage end of its adjustment range to begin with. Set the meter switch to Ip and talk into the mike loudly while keying the rig (use a dummy load of some sort as overmodulation is probable at this step). If the meter needle fluctuates with speech, you're overmodulating. Reduce the setting of R2 until no kick of the meter is observable. Then connect to an antenna and find a very critical friend on the air; have him check your signal for splatter several hundred kc either side of the carrier. If he finds none, you're at least on the safe side of the 100-percent-modulation mark. If you feel lucky or trust his judgment highly, increase the setting of R2 slightly until he reports slight splatter, then cut it back a tad.

Don't worry about any "distortion" he may report. If R1 is wide open and you're talking loudly, the signal will be very deeply clipped and may be almost unintelligible at short range. The only thing you're looking for right now is splatter.

A better method, of course, is to use a scope. Most any kind can be employed by coupling directly to the vertical deflection plates with a pickup loop made of two turns of "zip cord" hung near the final tank lines. With a scope, set for about 95 percent modulation and lock R2 with a drop of glue.

R1 is a semi-operating control; its setting will depend on your mike, your voice, and the amount of clipping you prefer. The lower the setting of R1, the less clipping you will have. It's possible to set it so low that you have no clipping at all, and a setting somewhere near this point will get you the best "broadcast-quality" reports from local contacts.

For long-haul work, however, anywhere from 10 to 20 db of clipping will vastly increase your coverage range. The price you pay is a slight amount of distortion on local contacts. It won't hurt the intelligibility of your signal but won't be broadcast quality either.

We found both the no-clipping and the 15-db points and marked the shaft of R1 so either could be selected in a hurry. The way to find them is simply to get into a round-table and adjust R1 until everybody reports "nice audio" for you. This is somewhere near the zero-clipping point. Then when the going gets rough, turn R1 up until you're getting through without too much distortion at the other end, and you'll be near the 15-db point.

That sets you up and puts you on the air; the rest is up to you. For guidance, the following meter readings are normal on the original rig: Ig, 0.8 (8 ma); Ip, 0.66 (200 ma); Mod, 0.15 to 0.4 (50 to 120 ma); and Output, 0.5 or more depending upon antenna and vswr.

If you want to know a little more about how the various stages of the rig operate, here it is. This won't have much effect on the signal quality, but may be helpful if you have need to troubleshoot later.

The 6EB8 oscillator tube is a triode-pentode, with the pentode section oscillating and the triode doubling. The oscillator circuit is a Colpitts, with the feedback to sustain oscillation being developed across a capacitive voltage divider composed of the 10 and 100 mmfd capacitors in the grid circuit.

The ratio of these two capacitors determines the amount of feedback, and feedback may be increased by either making the 100 mmfd smaller of the 10 mmfd larger. The .001 is simply a bypass for the cathode resistor, and has no practical effect upon the circuit.

For vfo use, the rf choke is shorted out and the stage then becomes a tripler for 8 mc input. However, in oscillator service (which will be the more common use) the screen of the pentode acts as a virtual plate for an 8 mc oscillator, and the frequency is tripled in the real plate circuit. L1 tunes the 24 to 24.667 mc range.

Link coupling from L1 to L2 in the triode plate discriminates against unwanted harmonics of the 8mc oscillator signal. The triode half of the tube doubles to 48-49.333 mc. Capacitor C2 balances out of the triode's output capacitance so that the C1-L5 tank is truly balanced; without C2 half of the next stage would get more drive than the other half.

The first 6360 is a tripler from 48-49.333 mc to 144-148 mc; it operates normally except that its cathode is brought out to the key jack and the screen is not bypassed. The screen bypass is not only unnecessary but actually reduces output for a 6360 due to the tube design.

The second 6360 is a straight-through driver to develop plenty of grid current for the 5894. Like the tripler, this stage is keyed in the cathode. Keying the exciter stages rather than the final reduces current through the key contacts. The potentiometer in the screen circuit of this stage controls its output, and thus the drive to the final.

The 5894 uses untuned grid circuitry, which must resonate *below* operating frequency. If resonated at or above the frequency of operation, oscillation is almost sure to result. Originally the final was neutralized, but this had no effect so the neutralizing circuit was removed in the interests of simplicity; the rig is complex enough anyhow!

The plate tank is a capacitance-loaded quarter-wave line. Its dimensions are not particularly critical as the tuning capacitor has a wide range. If it should tune too low, use less capacitance; if resonance is too high, use more. However, if you follow the dimensions within a half inch or so you should have no trouble.

In the audio circuitry, the 12AX7 is a conventional amplifier using contact-potential bias across the 4.7-megohm grid resistor for its first half, and cathode bias in the second stage. It drives the 12AU7 cathode follower, which provides a low-impedance source for the clipper.

The 12AL5 clipper acts just like a resistor in the line so long as the instantaneous audio signal voltage is less than the voltage applied to its plates, since both diodes are conducting. However, if the audio voltage goes higher than the plate voltage, the diodes cut off and limit the output voltage to the plate-voltage value. By selecting the plate voltage (through adjustment of R2) to be just equal to the voltage which will produce 100-percent modulation, overmodulation becomes impossible. This, in

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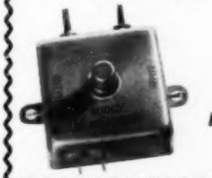

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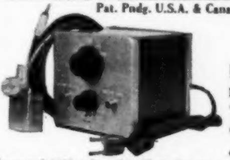

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turn, allows R1 to be turned up for "louder" audio without attendant splatter.

Because the clipping process generates audio harmonics which in themselves would create splatter, the clipper output goes through a filter composed of the choke and the two 270-mmfd capacitors. Any other filter design could be used but this is the cheapest and simplest we have found yet, and does a highly adequate job.

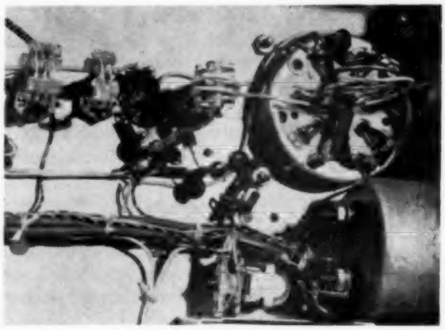
The second half of the 12AU7 used for the cathode follower is a "cathodyne" phase splitter. With equal-valve resistors in the plate and the cathode, it produces output voltages equal in amplitude but 180 degrees out of phase with each other. Voltage gain of this circuit is slightly less than one in either channel, so that an intermediate amplifier is necessary to bring the audio up to a level capable of driving the 807's to 60 watts output. Both the intermediate 12AU7 amplifier and the 807 stages are conventional push-pull audio amps.

The bias network in the 807 grid circuit allows operating bias to be selected for 50 ma resting plate current, while the relay associated with this puts 90 volts on the grids during standby to reduce power drain by cutting off the tubes. The other speech stages operate at all times.

The meter circuit may look a bit unusual; it allows use of standard-value resistors as "shunts." The 0-1 ma meter and the 1200-ohm resistor in series with it form a voltmeter with 1.2 volts full-scale reading. The "shunt" resistors in the metered circuits develop a voltage across them proportional to current flow; thus the 120-ohm Ig "shunt" develops 1.2 volts when 10 ma of current is flowing, while the 3.3-ohm Ip and Mod "shunts" develop 1.2 volts with 365 ma of current.

The meter movement is some 1600 volts positive to ground when measuring modulator plate current, but no trouble has resulted even though the case is shielded. The only trouble at all in the meter circuit has been the arc-over between switch contacts already mentioned, and this can easily be cured by interchanging Ig and Mod positions on the switch.

As mentioned earlier, this rig was designed for mobile use in conjunction with a power-supply originally installed for a Swan monobander, which provided 600 volts, 275 volts, +12 for filaments, and −90 bias. Actual voltage requirements can differ quite a bit from this, however. High voltage can be reduced as low as 500 without appreciable drop in output, and "low HV" can be anywhere between 250 and 400 (although at 400 volts, the value of the VR-tube dropping resistor probably would need to be increased; more than 150 ma would flow through the 30-ma tubes!). For home-station use the only problem would be the +12-volt supply necessary for the relays; we solved it by building up a small relay power supply separate from the filament supply line and running the filaments on ac.



5894 final grid circuit.

If you don't happen to have a 5894 around the house, there's no reason why an 829B couldn't be used at approximately the same power level. Output would be a bit less, but the difference probably would never be noticed at the far end. Similarly, a 6CX8 can be used instead of the 6EB8 oscillator-doubler, but no substitution for the 6360's is recommended.

In the audio, the 12AX7 and 12AU7 tubes are so readily available that no substitution should be necessary. If you can't find a 12AL5, you can use a 6AL5 with a dropping resistor in its filament circuit. Instead of 807's, either 1625's (if you can find or make sockets) or 6146's could be employed. If you'll be satisfied with 80 percent modulation, 2E26's might be used. Any of these changes in modulator tubes, however, might require quite a bit of change in modulator screen and bias voltages, as well as transformer primary impedance. Try them at your own risk.

And in the meantime, whenever the band is open to Oklahoma or vicinity, keep an ear cocked for W5PPE around 144.010. He'll be using this rig—unless we come up with a better one in the meantime, but from the performance of this one, that's not very likely!

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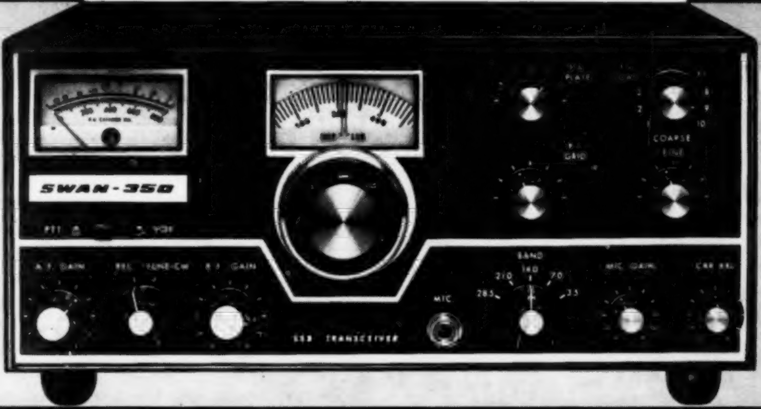

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More on that Simple TR Switch

So much interest has been shown in the author's article in May 1963 73 on a simple T/R switch that it seems to justify a few further notes on theory and operation for those who are using the switch.

First, a correction is in order. The value of the cathode resistor is 25 ohms, one-half watt —not "25W" as was shown in the diagram. However, this value is not critical and anything up to about 150 or 200 ohms should work well.

Theory

An appreciation of the theory of operation of this handy little device will give some insights into possible adaptations and modifications.

Rf energy from the transmission line is picked up capacitively and fed to the cathode of the T/R switch. This rf voltage appears across the relatively high cathode impedance formed by the rf choke and the resistor. And the voltage drop appears at the grid of the tube.

Small voltages, such as those received from distant stations, are amplified in the switch as a class A amplifier, and fed to the receiver by capacity coupling to the plate of the T/R tube.

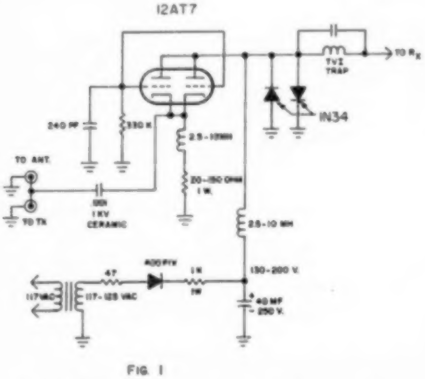

FIG. 1

Place .001 ceramic capacitor between plate-rc connection and 1N34's.

However, when the local transmitter is on, a large rf voltage appears at the grid, causing grid current to flow through the high value grid leak resistor. This produces enough grid leak bias (several volts) to shut off plate current flow in the T/R tube altogether. In this condition, the tube is a very poor amplifier, and very little of the transmitter output gets to the receiver—much too small an amount to do any harm. If reverse-polarity diodes are used across the switch output, this output voltage is clamped to a fraction of a volt, even in the event of a circuit failure of some kind. The capacitor paralleling the grid leak resistor is a "filter", which smooths the rectified rf to a steady dc bias. However, the time constant is short enough to "open up" the switch instantly when the transmitter is turned off.

Further receiver protection is offered by the high impedance output of the switch. This is capacity-coupled into the low-impedance input to the receiver—a very inefficient arrangement for transmitting damaging amounts of rf to the receiver.

QRO

Now, with all this in mind, it is obvious that a single dual-triode such as a 12AT7 should handle the duty for a full kw or more.

The cathode input to the switch presents a relatively high impedance to the low-impedance (50 to 100 ohms) transmission line. Therefore, very little rf power is absorbed by the switch from the feedline and most of this current flows through the cathode resistor and choke.

In actual practice, a single 12AT7 has been handling a full kw at W4MLE for nearly a year. The only breakdown was a filament burnout.

A precaution in switches for high power rigs might be the use of a fairly heavy rf choke in the cathode, and a one-watt resistor. In the author's several models of this switch, receiving type 100 ma rf chokes of 2.5 to 10 mh were used with one-watt resistors with only one failure. That was a resistor which went up in smoke due to a wiring error which put it directly across the feedline—in effect, making it a dummy load for 750 watts of rf.

TVI

Shortly before the previous article appeared in print, a TVI complaint cropped up which traced back to the T/R switch. Operation on 20 meters produced herringbone and bars on the TV set next door on channel 6.

There was no TVI from operation on any other band. And even the 20-meter TVI disappeared when the filament to the T/R switch was turned off.

The trouble was traced to the switch output to the station receiver. It was the receiver which radiated TVI generated in the switch! It was cured with a simple trap between the switch and the receiver line.

The TVI was not produced by the 1N34 diodes. It was present whether they were in the circuit or not.

Power Supply

The power supply for this switch can be simplified by using a resistive-input RC filter with a single capacitor if space is a prime consideration. Too little filtering, however, will result in a rough note on all received signals. See Fig. 1.

SWR

Referring again to the discussion of the theory of operation, it is apparent that a high VSWR on the transmission line will result in relatively high rf voltages being applied to the cathode of the T/R tube.

In a 1 kw class C, CW amplifier feeding a 70-ohm transmission line with a 1:1 VSWR, there will be a maximum of about 200 to 250 volts across the transmission line, assuming 700 to 750 watts output. Double that for plate-modulated AM or 2kw PEP SSB.

As the VSWR increases, however, these voltage maximums rise very steeply. A 3:1 VSWR should give peak voltages exceeding 1500 (2kw PEP) across the feedline, and presented to the switch input.

This results in considerable stress on the input capacitor to the switch, and presents the 12AT7 grids with peak voltages and currents which they weren't exactly designed for.

Even so, there has been no indication of component failure so far in any of several such switches used by the author, despite several instances of transmitter tune-up on the wrong antenna, with astronomical VSWR figures.

. . . W4MLE

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The Disguised TWIST

"Tut" Tuttle WA6LUM

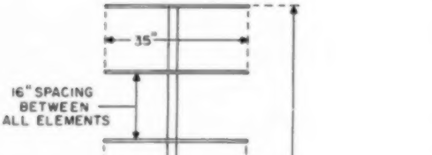


Fig. 1—Dimensions and element spacing. Elements in opposite plane are identical. See Fig.2.

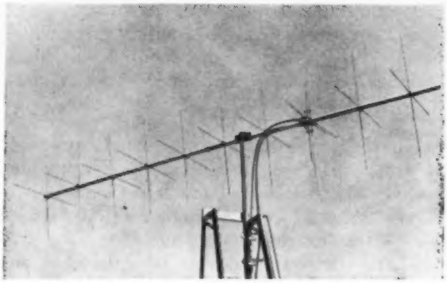


Fig. 2—Complete "twist" on 16' test ladder. Note uniform 16" element spacing and line matching elements.

In some areas the two meter band is a hodge-podge of vertically, horizontally and spirally polarized signals. Available antennas work very well in one mode but always discriminate against others. The "Disguised Twist" is an attempt to provide a single array that would give optimum results utilizing vertical, horizontal, clockwise or counter-clockwise spiral patterns. The pattern is easily selected with a twist of a knob at the control point.

The antenna was designed and built by Buddy Alvernaz W6DMN, Dave Mauro W6LXK, and Rudy Stefenel W6OQW, as a joint effort. The boom is 1½" aluminum TV mast, 13 ft. long. The elements, cut to length as shown in Fig. 1, are mounted on 16" centers as shown in Fig. 2. ⅜" aluminum tubing from scrapped TV antennas was used for the prototype elements. The driven elements are T matched to 200 ohm twin lead (K-200). Fig. 3 shows the matching elements and their plexi-glass mounting plate in place on the boom. The K-200 feedlines between the switch box and the driven elements are exactly one half wave long, as shown in Fig. 4. When the antenna is used to give a spiral pattern, these feed lines are in parallel with a reflected impedance of 100 ohms. This is re-matched to the 200 ohm transmission line through a matching stub at the switch box as shown in Figs. 4 and 5. In spiral modes an extra ¼ wave length of K-200 is switched in series with one or the other of the ½ wave lines between the switch box and the driven elements. The direction of spiral is determined by which line has the added length. Again, see Figs. 4 and 5.

The switching is accomplished with three Jennings RB-3 vacuum relays. The switch box containing the relays, matching stub and ¼ wave phasing section (see Fig. 5) is mounted on the mast about 30" below the

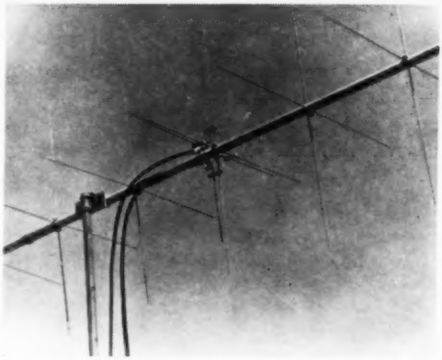


Fig. 3—Details on matching units and feed line mounting. Switch box not shown.

boom. Several heavy coats of acrylic spray were applied to both the antenna and switch box before they were finally erected.

The dimensions of the various matching elements were determined for a frequency at the low end of the band through careful cut-and-try, with the antenna mounted on a 16 ft. ladder as shown in Fig. 2. A Bird Model 43 VSWR bridge was used in this time-consuming operation. It is very important that all elements be carefully matched, with a minimum VSWR. Mis-matching can cause some mighty weird patterns.

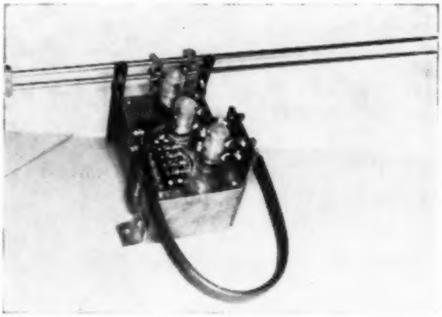


Fig. 4—Switch box details, showing 100-200 ohm matching stub and phasing section with their associated relays.

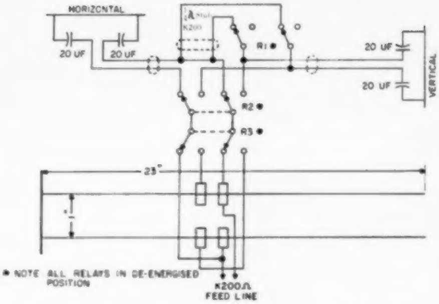


Fig. 5—Switchbox circuitry showing relays and impedance matching circuits. All relays are shown in de-energized position.

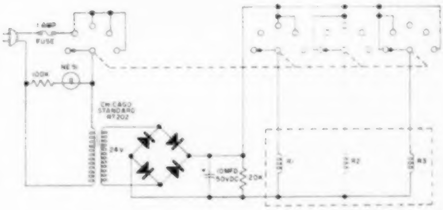
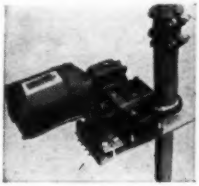


Fig. 6—Control box circuit. Relays require 500 ma at 26 volts dc. An inexpensive bakelite wafer switch does controlling.

The control box, Fig. 6, consists of a 26 vdc power supply for the relays and a four deck wafer switch for control. Five switch positions are provided: off, horizontal, vertical, clockwise spiral, counter-clockwise spiral.

The "Disguised Twist" has been in service for several months at the Sidewinders Radio Club (Jennings Radio Mfg. Corp), with some unexpected results. Generally the best results are with the twist matched to the mode of the station being worked. At times a flip to cross polarization will raise signals in both directions. At other times and on the same path, a spiral pattern will give best reports. The antenna is still under study and more dope will be forthcoming at a later date.

. . . WA6LUM



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	300-C	50-54	14-18	$10.95 ppd.
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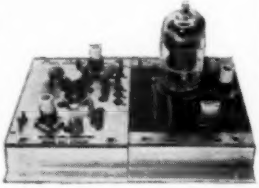

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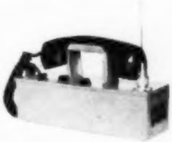

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Jon Butler WA4INJ
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The Backward Upsidedown Halo

I had just made a purchase at the friendly neighborhood radio store and was returning to my car, when a little red Volkswagen squeezed into a parking space adjacent to mine. As I was edging my way into the driver's seat, being careful to avoid a collision between my door and the little red Volkswagen, the driver of said same car was eying my halo. After several minutes of maneuvering, I managed to shoot through—all this oblivious to my preoccupied friend. I slammed the door a little harder than usual. Apparently I broke the trance, because he yelled over, "Hey, buddy, didya know your halo's turned around?"

"Yes, I know. It keeps the capacity. . ."

"Not only that, it's upside-down. What are ya, some kinda nut? What kinda SWR do ya have anyway?"

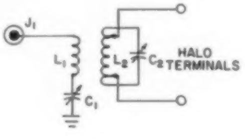


FIG 1

Parts List

C_1—75 mmfd variable; Hammarlund APC-75
C_2—50 mmfd variable; Hammarlund APC-50
L_1—3 turns wound around L_2 (close spaced)
L_2—9½ turns of #10 or #8 wire wound on a ⅝" form. Coil length 2¼"
J_1—SO-239

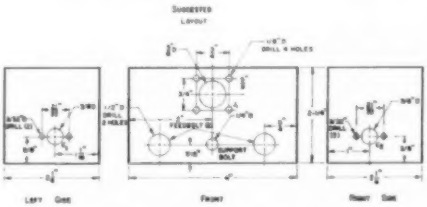
Well, what do you say? After many frustrating hours of making and adjusting quarter-wave feeds and autocoils, halo right side up and upside-down, I was ready to say yes to his first question. I grudgingly admitted that my SWR was about 3 to 1. Certainly this didn't convince him of my sanity. Then and there I decided to start all over and try something new in the line of halo matching. Not only did I want a decent SWR, but also, I wanted a match which was adjustable—easily adjustable. This means no more settings which looked perfect until you stepped five feet away! And thirdly, I wanted a system which would fit into a compact container. With the fact in mind that anything I did to the halo would be an improvement, I left my friend mumbling to himself something about "what this world was coming to," returned home, and started digging into the junkbox. Here is the result.

The Matching System

The matching system is made up of two tuned circuits link coupled to each other. One tuned circuit is in series with the 50 ohm feedline and controls the amount of coupling. The other is in parallel with the halo and determines the operating frequency. Rf is tapped off this second tuned circuit and fed to the halo. This arrangement matches the two impedances and effects an unbalanced-to-balanced match as well. Because the input of the matching system is a tuned circuit the length of the feedline is not important, as it is in a quarter-wave matching system.

Construction

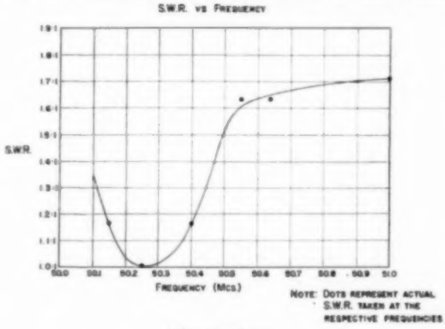
The unit is enclosed in a 4¼" x 2¼" x 2¼" minibox chassis. A larger chassis can be used if more room is desired.



To mount the minibox the halo must be flipped over, so that the driven element is on top. ½" is sawed off the top of the halo mast to allow clearance for the SO-239 antenna jack. Incidentally, the halo operates just as efficiently upside-down as right-side-up. The minibox case is supported by the higher of the two halo-mast bolts. 1¼" on each side of the hole for this bolt are ½" dia. holes which pass the feed-bolts. Large fiber washers are used to separate the feed-bolt nut from the chassis.

Ground lugs mounted on each feed-bolt provide a means of connecting the halo to the taps. Small alligator clips are used as taps for the coil.

C1 and C2 are not particularly critical, and many capacitors of nearly the same value may be substituted. It is important, however, that both stator and rotor plates of C2 be above ground. The APC capacitors recommended in the parts list are tuned with a screwdriver. They will serve the purpose nicely since, once set, it is unlikely that they will be tuned again.



Operation

With an SWR bridge in the feedline, position the taps of L_2 so that they are 2 turns each side of center. Place the cover on the minibox, and adjust C_1 and C_2 for the lowest SWR. Since tuning one will affect the other, first tune C_1, then C_2, then C_1, etc. Repeat this procedure, if necessary, changing the tap settings each time. At the resonant frequency of the halo (50.25 mc in my case) the SWR is very near 1:1. Fig. 2 shows how the SWR varies across the first megacycle of six meters. A word of note: As a matter of practice I keep the halo capacity plates as far away from the car body as possible. This is to avoid detuning effects. Any metal near the capacity plates will change their capacity and thus the operating frequency. This method is quite the opposite to the conventional method (having the ring extend forward). I have found that on my car there is little difference, if any, between the two positions. If you want an "extra margin", however, the halo ring should extend to the rear. On some vehicles, such as a station wagon, where the capacity plates are less than a foot or so from the body, it may be absolutely necessary to mount the halo "backwards", if detuning effects are to be avoided.

Conclusion

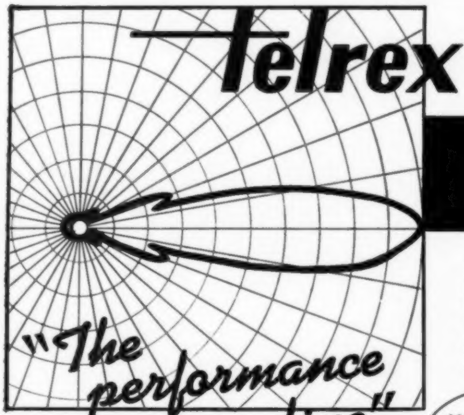
The tuning system has proven to be quite an improvement over past matches. This was unmistakably shown during a visit to my former QTH in the hilly section of Northeast Pennsylvania. Stations were able to copy me solidly, without interruption, along routes where I previously suffered fading and low signal strengths with the quarter wave match.

Since the tuning system is easy to adjust there is no problem if I want to operate with a 1:1 SWR on any other part of the band than 50.25 mc. All I need do is adjust the capacity between the two capacity plates, retune the match, and I'm in business.

The aluminum box has proven to be a blessing too. All connections, including the direct connection to the halo, are protected from rain, wind, and dirt. That means no corrosion.

And best of all, I no longer become frustrated when people, like the gentleman in the Volkswagen, ask me what is the SWR of that backward upside-down halo.

. . . WA4INJ



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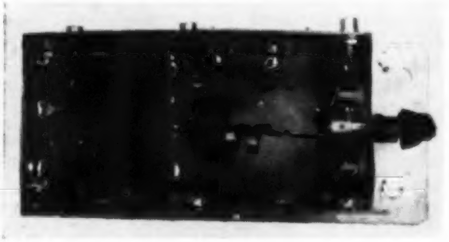
Introduction

In some of our notes on frequency multipliers we have mentioned listening to the output. With *transistor* multipliers this can be important. Of course you can also look, or measure. In fact, on certain projects I like to do all three at once. A change of note, a little overmodulation, a waveshape change, spurious signals, etc., can be heard as soon as they happen, looked at on the scope, and measured on a meter.



VHF Detector.

There are a series of handy-dandy little units which you will find very useful for picking up such signals including the desired ones, and for watching small amounts of rf volts like from transistor multipliers before they are full-grown. I will describe some for lower frequencies also because they will do things which the usual run of grid dippers do not, such as serve as mixers or video detectors.

Of particular interest I believe, should be the 400 to 500 megacycle unit, which makes an awfully nice mixer for the 432 band, and also for amateur Tee Vee.

General Purpose Untuned Detectors

Fig. 1 shows a little gadget of great utility around the shack bench. The input capacity, the choke, the rf bypass C3, and the dc load, R1, should be of different values for different groups of frequencies for best results. In the *if* regions you can use .001 mfd for C1. In the HF range 3 to 30 megacycles, use a 7-45 mmfd mica trimmer and from then on up use a small .8-7 mmf one, with the adjusting screw end connected to the choke rfc. That is, leave the smallest amount of metal connected to the test point. Also, use "pee-wee" alligator clips. C2 is a ground isolating capacitor. Lets you connect the gadget across a plate coil with B plus on it. (Not a kilowatt tho!)

Rfc can be a Tee Vee peaking coil for use on the *if* frequencies. I have even used an old audio transformer secondary when using this gadget around 2 kc. For the HF regions use a "standard" 2.5 mh choke. For the UHF region wind your own. About six pie sections of 5 turns each no. 34 to 36 wire is good, on a ⅛ inch form. Put your finger on it once in a while if in doubt. If that does anything except decrease the output meter, use more wire!

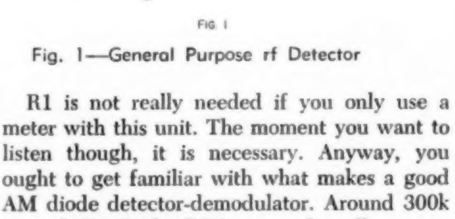


FIG 1

Fig. 1—General Purpose rf Detector

R1 is not really needed if you only use a meter with this unit. The moment you want to listen though, it is necessary. Anyway, you ought to get familiar with what makes a good AM diode detector-demodulator. Around 300k is good. For "video," R1 gets real small.

C3 also depends on usage. For measuring you can even slow down your meter action if you use many mfd's. Seriously, a good value for AM voice demodulation is 500 to 1000 mmfd. You leave this in for most everything except video. You might use as little as 10 mmfd there. C4 is just an af coupling. Use .01 for video; this may go *up*. Remember, 30 cycles? So, enough on this one. You can see there is quite a lot to even the simplest gadget, if you want to cover the foul lines as well as left field.

VHF Tuned Detectors and Mixers

This section, like the preceding one, will be kept short, as the main interest is considered to be in the 400 megacycle region, where low-cost, easily handled, good tuning, working units are not too well known as yet.

Fig. 2 shows the essential details. A unit useful from 6 to 2 meters is shown first mainly for description purposes, although when a special frequency detector or mixer is needed for VHF it is very nice to have one handy. Some interesting experiments can also be done on wire wound coils versus "helix" coils.

The box, not quite yet a trough line, is made of standard (for this experimenter) copper-clad bakelite, and can be fitted with a top cover which does not change results much except to cut down rf leakage. All rf and *if* components are kept inside and shielded, with feed-through and leakage in mind. There are two types of leakage involved; the first concerning the rf under investigation. When magnetic or voltage probes are used on the input jacks for circuit, antenna, harmonic or parasitic energy checking, etc., it is necessary to avoid direct coupling into L1 itself. Otherwise the probe in use will not be able to tell the proper story about what is going on. Also, antenna experiments are often run with long cables so it is of considerable interest to avoid direct pick-up, even of weak signals (and ignition) on L1.

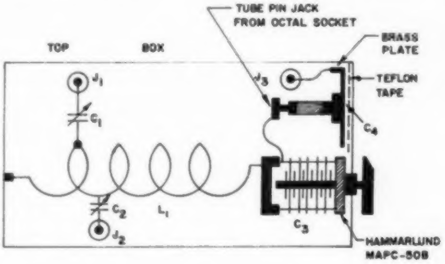


FIG. 2

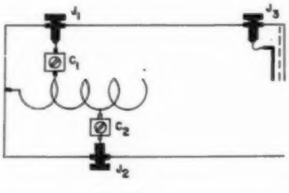


FIG. 2B

Fig. 2—Side View, VHF Detectors
Fig. 2B—Top view

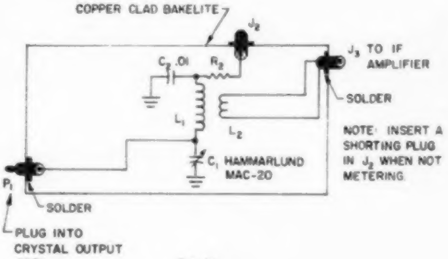


FIG. 3
IF OUTPUT CIRCUIT

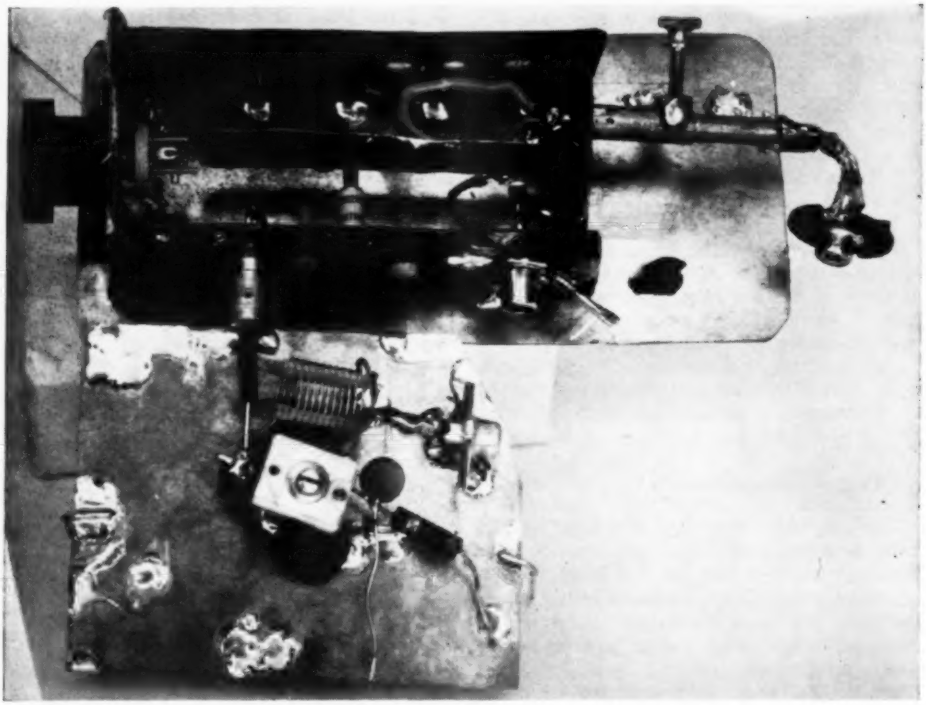
Fig. 3—if Output Circuit

The second leakage is of course at *if*. Note the very simple arrangement to prevent this. The blocking, or rf bypass capacitor C4 is built into the crystal holder (it actually is the crystal holder) and is on the *inside* of the box and close to the output jack. The capacity of this unit is of some interest as it forms part of the tuned *if* output transformer. A word here about crystal mixers. Every time I have used the circuit of Fig. 2 it has worked right away. Refinements can be added or a strictly fixed-tuned converter can be used, but this unit can be made to do almost anything in the VHF-UHF mixer line, especially as a *tunable* front end.

C4 also serves as a dc bypass capacitor when a meter is plugged into J3 for measuring purposes, although you may add more capacity to C4 if you use the unit for dc only.

Note that several circuits can be plugged into J3. The dc crystal current is present, for metering. Different *if*'s can be plugged in, as needed, outboard *if* pre-amps can be tested, etc. Fig. 3 shows a "crystal-*if* output box" which is very handy. P1 plugs directly into J3 of Fig. 2. C1 should be large enough to tune L1 to the *if*, including the capacity of C4, and the jack and plug. C2 and C3 may be .01. R1 is "what suits the particular crystal" and the excitation used. I have generally found this to be between 1K and 3K.

Caution! When using high *if*, such as 52-53 megacycles (my old favorite broad-band ASB-7), P1 and J3 leads must be kept real



400-500 mc detector-mixer at top. IF output at bottom.

short. 50 megacycle circuits do *not* like to be tuned through long leads. You will be baffled by the most peculiar sort of mushy, backward, (just plain lousy) tuning you ever saw. Like when you have a FB capacitor with a couple of good clip leads about four or five inches long, and it works fine on tuning coils around 5 to 10 megacycles, but up on 6 meters it just goes Blah! Of course you can build the *if* output circuit in another box right alongside of the Fig. 2 box.

You *may* not like all this experimentation at every step, but if you do go through with it you *will* learn some practical matters about VHF and UHF detectors and mixers! We are actually not getting into the theory of mixing at all. This *really* gets deep if you do delve into it. I have several large books (one at $12.50 on this one subject alone.

Just for fun, and to check a crystal mixer on HF which I don't seem to recall having done before, I put into the box of Fig. 2 a 32 turn coil of 16 turns to the inch airwound, for L1, tuned by a 50 mmfd capacitor for C3. It tuned from 12 megacycles to 35 megacycles and sure pulled in 20, 15, and 10 meter amateur stations (and a lot extra as well) using a signal generator for the local oscillator, plugged into J2.

The *if* was tuned to 3.49 megacycles and used the circuit of Fig. 3 with two inches of 32 turns-per-inch *if* coil tuned with about 140 mmfd for C1.

Incidently, C4 in Fig. 2 was tested to be 75 mmfd. That is, with a somewhat loose brass plate for the crystal holder-output capacitor asembly. Two layers of sticky Teflon tape were used for the insulator of C4.

With 11 turns of 6 turns-per-inch airwound coil for L1 of Fig. 2, the circuit tunes to 6 meters. With 4 inches of straight copper wire for L1 it tunes from 75 to 200 megacycles, still using the 50 mmfd capacitor. Now watch! Just taking out the straight heavy wire and putting in copper strap (also 4 inches long) in its place, changed the tuning range to 80 to 250 megacycles. See also later paragraph on "Helix" coils.

Putting in a small Johnson type 9 mmfd capacitor, the same circuit tunes from 165 to 285 megacycles using a 5¼ inch strap 1 inch wide. Putting a top cover on the box, the range went to over 300 megacycles but did not change power much. Use top cover for

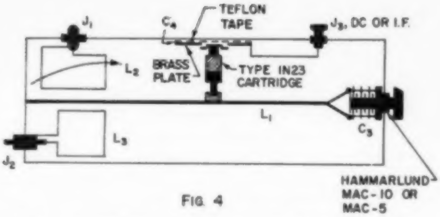


Fig. 4—400 to 500 mc Detector-Tuner-Mixer

maximum shielding, I guess.

Now for wire versus "Helix" coils. Of course, a Helix Coil sounds a lot more impressive than a strap coil. Suit yourself. The circuit of Fig. 2 lends itself well to this check. L1 has only two major connections, except for C1 and C2 which are easily soldered on. As an alternative, J2 (or J1 also, see also the UHF tuners) may feed a loop coupling to L1. In fact, for best tuning range, use coupling loops. See Fig. 4. As an example of wire versus strap, L1 was made of three turns of heavy copper wire, no. 14, and tuned 120 to 210 megacycles using the Johnson 9 plate capacitor 9 mmfd, with a box 3½ inches long by 3 wide by 3 deep. Just changing to three turns of ¼ inch copper strap makes the tuning range from 160 to 280, with the 220 band right in the middle of the range. The copper strap coil is about 9/16 O.D. and is about an inch long, with some 3/16 spacing between turns. It is air supported and there are about ⅜-inch straight copper straps as leads on each end.

And Now For 432

There have been quite a few circuits shown for 400 megacycles. Some of them show various kinds of small coils, loops, and what have you—attached to a crystal mixer, in one way or another. Plenty of tube mixers have also been described, but here we will concentrate on crystal diodes since they are simple and effective. At any rate, my thought here was to make up a tuned rf detector that would serve also as a mixer, be sure-fire and fool-proof, and be low in time and cost demands. I have already made one that works FB as mentioned above, but is a coaxial unit.

Fig. 4 shows the result of this easier-to-make trough-line venture. It tunes from under 400 to over 500 and covers RADAR, amateurs, RADAR, mobile and CB bands (UHF), and takes in the first few UHF Tee Vee channels. It works FB as an rf power detector and also as a mixer, *now*, but it has been a battle to get the latter fool-proof. First, as a detector. No trouble here. Again, the influence of the wide strap for L1. Using a one inch wide strap for L1 pushed the frequency quite a way up and increased the Q. Using a regular "store-bought" tuning capacitor for C3, a Johnson 5 plate type (I believe it is about 9 mmfd at maximum) it tunes excellently, going from under 400 to over 500 megacycles. It pulls in Radar (of course) with only an af amplifier plugged into the output jack. It works a meter FB, showing several volts dc from a small transistor UHF signal generator. (What's that? you want one of those too? OK, but later).

The position of the two input jacks and their taps on the main tuning strap, Fig. 4, was carefully tested. Be careful on this! A small loop of wire at L2, grounded at one end and terminated by an *open* jack resonates right in the middle of the band. (See also later.) (About variable coupling loops.) As a mixer it handles very well also. With attention to the antenna and oscillator couplings and my old favorite broadband *if* hooked onto the output, that is. This is an ASB-7 using 55 megacycle *if* for the first section, then changing to 15 megacycles. It was built by G.E. during WW2 and still works good. Using a transistor local oscillator tuning 450 to 550 megacycles, the ensemble makes a very interesting tunable receiver for the range 390 to over 500 megacycles. If you want one! I did.

An interesting item concerns loading with the two inputs variable as shown in Fig. 4. A signal on J1 produces 3 volts dc out of

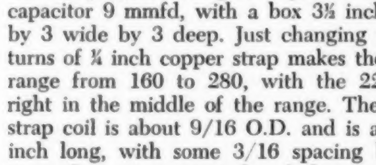


FIG. 5

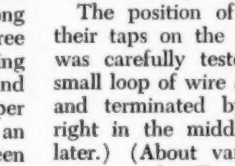


FIG. 6

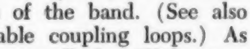


FIG. 7

Fig. 5—Coax Coupling Loop detail
Fig. 6—Phone Jack Variable Coupling detail
Fig. 7—Locknut detail

J3. That is, when the J2 loop L3 is *decoupled*. See also Fig. 5. When a resistor is placed across J2's output cable and L3 is coupled *into* the magnetic field of L1, the output voltage drops to 1½ volts. A matched 432 megacycle antenna has the same effect. As a mixer, the two variable coupling loops work like little charms. With the set up I tested. The oscillator loop needed to be only about ½ coupled, that is, at about 45 degrees. One thing was sure, you could now maximize the antenna and the oscillator injection coupling. This was using a tuned transistor local oscillator.

Antennas get to be a problem with 100 megacycle tuning range. Such things as log-periodic antennas do exist, of course, but as an amateur DX fanatic I like a narrow band high-gain job. Take your choice. Using an indoor dipole, several very loud 450-470 megacycle stations were heard—probably in the mobile, business, or UHF CB bands. My main interest is, of course, on 432 for good old DX, when and if! For ATV this unit should be very FB. Bandwidth can be adjusted, antennas matched, video and sound outputs tuned up, etc. That, of course, is still another story. We do have also a good strong power oscillator for 440 (see 73 Mag.). These two should be ideal for good power on ATV.

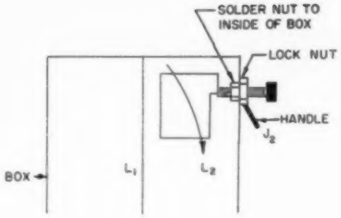


FIG. 8

Fig. 8—Phono Jack Variable Coupling detail, top view

Some details now on the two variable coupling methods. Mechanical, mostly. Fig. 5 shows one method of obtaining variable loop coupling. A one inch section of ⅜ inch copper tubing is drilled out for a 6/32 thumb screw and a brass nut is soldered onto it. A two inch long piece of ½ inch copper tubing is prepared with RG58/u inside, first removing the black cover. Feed it into the ¼ inch tubing and remove about two inches of the tinned copper brain. The insulated center wire comes out of the ¼ inch tubing just inside the rear wall of the box of Fig. 4. It forms a loop roughly ⅜ inch long by about ⅜ wide, and should turn freely in the space between L1 and the inside of the box. From tests, this loop could be even smaller.

The second method tried goes quicker and works the same. Suit yourself. A phono jack, single mount type, is prepared by filing a slight flat on the tip of the thread. See Fig. 6. This serves to solder the ground return side of a loop. See also Fig. 4 again. A phono jack nut is soldered to the inside of the box wall, over a ¼ inch hole in the same wall. Another phono jack nut has a heavy wire loop soldered around it to form a handle for using it as a locking nut on the outside of the same box wall. See Fig. 7. The whole shebang is shown in Fig. 8. Looks kinda crude but works like a charm. Where can you *buy* one like it for 432? You have to file everything nice and flat on that assembly, by the way, or you can't get both nuts on and working right.

Conclusion

A series of tuned rf dectectors and mixers has been described, with particular emphasis and detail on a practical 432 megacycle tuned crystal mixer. This mixer can form the heart of a low cost 432 receiver.

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UHF Signal Generator

If operators on our sparsely populated UHF bands were obliged to wait for the appearance of an air signal on the band in order to align a converter or tune up a preamp many would probably grow long grey beards (apologies to Sam Harris) before the converter or preamp was ready to go.

Front view of signal generator.

Having worn out several razor blades over this problem myself, I set out to seek a solution to the problem.

Investigation revealed four possible solutions: buy an electric shaver, convince more hams to build UHF transmitters, quit ham radio forever (again?), or build a signal generator.

All of these were tempting but the last was finally decided upon.

Several requirements were the basis for the design of this signal generator: operation on both 432 mc and 1296 mc, high stability e.g., crystal control, variable rf amplitude, provision for insertion of various types of modulation, and lowest possible cost consistent with satisfactory operation.

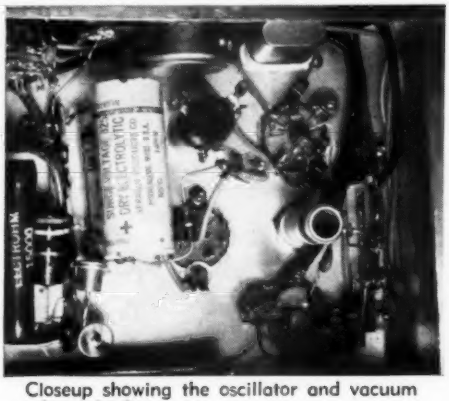
I had a 27.005 mc overtone crystal left over from a brief period of disillusionment about CB and, since 27 times 6 is 432 which times 3 is 1296, this seemed a likely place to start.

Fig. 1 shows the final result. The overtone oscillator is voltage regulated and is left operating at all times when the generator is on. The crystal is mounted underneath the chassis to protect it from rapid temperature changes from drafts, etc., further enhancing the stability.

The use of diode multipliers at 432 mc and 1296 mc greatly simplifies developing UHF rf.

Direct coupling the modulation into the cathode of the last vacuum tube multiplier provides a modulation input that will accomodate almost any signal from audio to video, or even pulse.

A four position mode switch on the front panel allows the choice of carrier, no carrier, carrier with 60 cycle modulation and finally carrier with external modulation.



Closeup showing the oscillator and vacuum tube multipliers.

Construction

Building the unit presents no special problems except getting it all under the chassis. The 5 x 9½ x 2½ chassis doesn't leave much useful room to spare, but it does make for a very compact device.

The lengths of the diode multiplier tuned lines were determined primarily by the space available and bear only the slightest relation to the wave lengths involved; hence, it was necessary to pad both lines with additional capacitances in order to resonate them properly.

Both lines were folded from 1/32 inch brass sheet stock. The inner conductors are made from ¼ inch brass tubing. The 432 line is 1" x 1" x 7". The input diode is tapped onto the inner conductor 1¼ inches from the other end. The signal output loop is about 1¼ inches long. The output diode is tapped 2 inches from the loop end of the line.

The tuning capacitor is made by soldering a 10-32 nut over a hole in the middle of the line shell. This provides the threads for the 10-32 screw which actually serves as the capacitor.

Round ½ inch disks are soldered to the bottom of the center of the inner conductor and to the end of the turning screw to provide additional range.

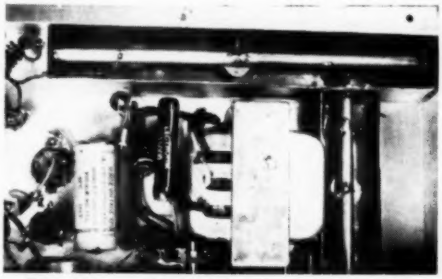
The 1296 line is similar except it is only 3⅜ inches long. The multiplier diode is tapped on the inner conductor ⅝ inches from one end. The signal output loop is about ¾ inches long and is located at the other end of the line. The tuning capacitor is identical to the one used in the 432 line.

The 15K 10 watt resistor in the carrier OFF position limits the no load voltage from exceeding the ratings on the filter capacitors.

Operation

The tune up of the tube stages can be easily accomplished with a grid dipper. The UHF stages should only need to be peaked with a converter and receiver.

Shields on all tubes and a bottom cover on the chassis are important requirements if stray leakage at the signal frequency or lower harmonics is to be eliminated as a possible source of measurement error. These were removed for the photographs but are always used in practice.



Closeup view showing details of diode multipliers lines.

For best results it is a good idea to employ a 50 ohm (or 75 ohm as the case may be) pad between the signal generator and the equipment under test. This will insure that the generator will appear as a resistive load as much as possible. This is necessary if the generator is to duplicate the conditions presented to the receiver by a good antenna.

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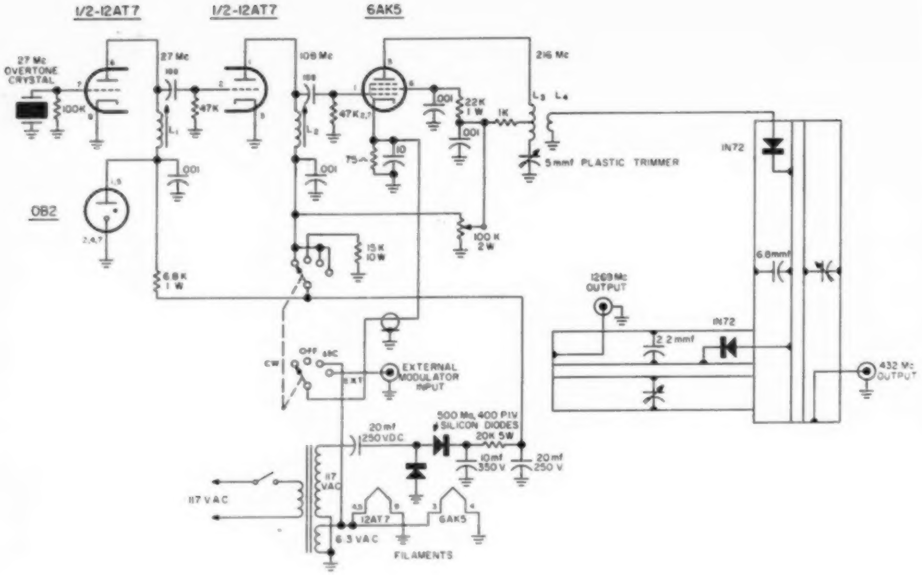
1/2-12AT7
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100K
27 Mc
100
47K
L1
.001
OB2
108 Mc
100
47K
L2
.001
.001
22K 1 W
.001
75~
10
1K
216 Mc
L3 L4
5mmf PLASTIC TRIMMER
IN72
100 K 2 W
15K 10W
6.8K 1 W
6.8mmf
1269 Mc OUTPUT
IN72
2.2 mmf
432 Mc OUTPUT
CW
OFF
INC
EXT
EXTERNAL MODULATOR INPUT
20 mf 250 VDC
500 Ma, 400 PIV SILICON DIODES
20K 5W
10mf 350 V
20 mf 250 V
117 VAC
117 VAC
12AT7
6AK5
6.3 VAC
FILAMENTS

FIGURE 1

L1—10 turns # 28, 3/8" slug form.
L2—3 turns #28, 3/8" slug form.

L3—10 turns #18, 1/2" dia.
L4—3 turns #18, 1/4" dia.

This pad can take many forms. The two easiest ways to make one would be to use sufficient lengths of some lossy coax. At 432 mc higher, 20 or 30 feet of RG-58 (or RG-59) seems to be quite adequate for most applications. The other approach would involve building a conventional resistor pad into a male and female BNC connector soldered back to back. Fig. 2 shows such a pad.

Aside from receiver testing, this device has several other uses to which it can be put. It is also useful as a signal source for antenna tests and it may be used as frequency standard.

This last use can be of great value at UHF because of the persistent problem of crystal tolerance versus frequency multiplication. A converter can easily be 40 or 50 kc or more off of the indicated frequency at 1296 mc. This can be quite a problem if you are hunting for a moonbounce signal through a 5 cps filter.

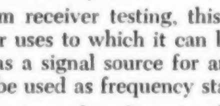

FIGURE 2

Fig. 2. 20 db 52 ohm pad. Resistors mounted in BNC connector.

Though not shown on the diagram or in the pictures, it was found that a 50 mmfd variable capacitor connected across the crystal was sufficient to reduce 27.005 mc to the 27.000 . . . mc required to put the generator on 432.00 . . . and 1296.00 . . . mc. It will probably be necessary to retune the oscillator plate circuit for best operation; some loss in output will be encountered but this should not be a serious problem. However, if such operation is contemplated, it might be of some advantage to obtain a 27.002 mc crystal and employ a smaller variable capacitor.

In order to make the frequency standard really something of a standard, a 1 mc calibration oscillator should be employed. Some harmonic of the oscillator (5 mc, 10 mc, etc.) should be zero beated against WWV. The signal generator should then be zero beated against the 27 mc harmonic of the 1 mc calibrator—presto!—a 432-1296 mc frequency standard.

Though there are many refinements which can be made, the unit described has done a yeoman service in all the varied tasks asked of it.

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Just a Piece of Wire?

One of the biggest bug-a-boos in the construction of VHF and UHF gear is the interconnection of the individual components which make up the system. The cardinal rule of good construction has always been to keep the leads as short as possible. This is a pretty loose rule and to the newly arrived VHF enthusiast, presents a perplexing problem when he begins to layout his new rig. The following graphs might be valuable in providing an insight into this problem as well as providing valuable design information for the construction of future equipment.

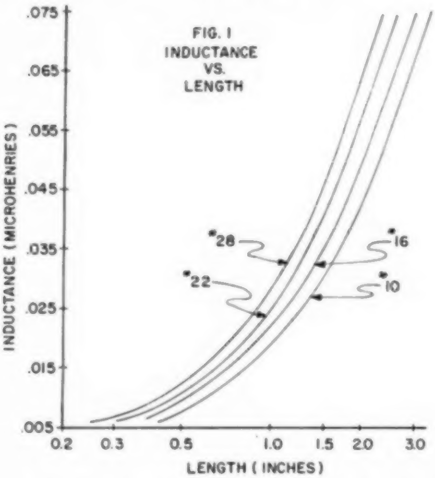

FIG. 1
INDUCTANCE
VS.
LENGTH

The inductance of a length of wire has been given as [1]

$$L = 0.005l[2.3\mathrm{Log}_{10}\frac{16l-3d}{4d}]$$

where L = Inductance in microhenries
l = Length in inches
d = Diameter in inches

This is shown in Fig. 1 for various wire sizes from #28 AWG to #10 AWG. These sizes were selected as representative of the various sizes used in amateur gear today.

Fig. 2 demonstrates the size of the reactance which can be associated with a short length of wire. This is a graph of the reactance versus frequency for a one-half and a two inch length of #22 wire. Notice that at 140 megacycles the reactance is 10 ohms for the one-half inch length. However should the length be increased to two inches as it might be in order to reach from a plate cap of a 2E26 to a tuning capacitor on the front panel, the reactance would increase to 50 ohms. This increase in reactance could conceivably prevent the tank circuit from resonating or from loading properly in the two meter band, causing considerable head scratching on the part of the builder.

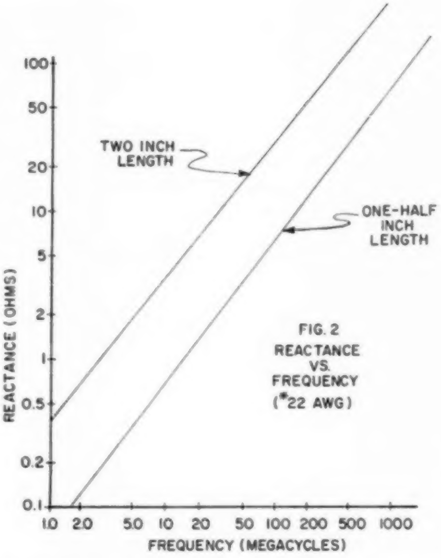

FIG. 2
REACTANCE
VS.
FREQUENCY
(#22 AWG)

It is hoped that the illustration of one of the potential problem areas and a judicious use of the curves will aid in avoiding some of the pitfalls inherent in VHF construction. Always analyze the effect the additional inductance as determined from Fig. 1 would have on the critical path and modify the layout accordingly. And remember: in VHF, all paths are critical.

. . K5BLF

Reference

1. F. Langford-Smith, *Radiotron Designers Handbook*, p. 1287

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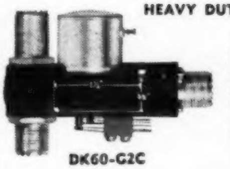

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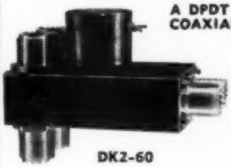

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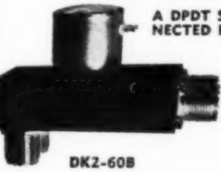

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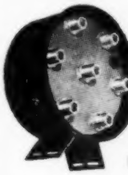

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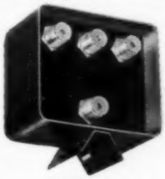

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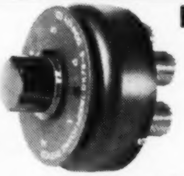

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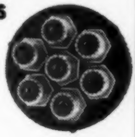

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Homer Gaston W5CZ

The Amateur and Civil Defense Emergencies

The next two or three years may be vital to the continued existence of Amateur Radio as we have known it. I have been a ham for fifty years and have never seen our ranks split as badly as they are now. Even during the Spark-C.W., C.W.-Phone, and AM-SSB family fights, we did not have the dissension we have had since the ARRL's incentive licensing proposal.

It is not my intention to discuss this proposal here except to say that regardless of its merits, and it has some, it was the worst handled matter to come out of ARRL in many years. The preliminary ground work was terrible.

Now let's talk about another controversial subject—Civil Defense and what you can do about it. Just because your local CD organization may not be too good (and have you taken the time to find out why it is or isn't good?) doesn't mean that in an emergency it will not determine whether people live or die. And before we get any further, quit thinking that CD will only function in a nuclear war. That may be true at the National, Regional and some State levels but your local and county CD organizations are vitally concerned with natural disasters such as floods, hurricanes, tornadoes, and so forth.

Civil Defense has been defined, somewhat inaccurately, as "Government in Emergency." Change that to "Governmental directed activities in an Emergency" and you will be much nearer the truth. Many volunteers not normally in government, except as taxpayers and voters, will be required in almost all large disasters and many small isolated incidents.

Now we come to something that conerns us all as radio amateurs.

In any emergency, the need for governmental communications becomes paramount. Not only are more circuits needed than in normal times but circuits are needed to locations which normally have little or no communications. The provision of these circuits whether wire, radio or by other means requires careful advanced planning. Even with the best planning cases usually arise where more emergency links are needed than anticipated.

RACES (Radio Amateur Civil Emergency Service) was established by the U. S. Government some years ago to provide the government at all levels, local, State and National, with an amateur radio back-up facility in emergencies. It is probably most comparable with the MARS facility which furnishes emergency and other communications for the various Armed Forces. One important difference is that while MARS is assigned frequencies outside the amateur band, the RACES frequencies are all within the amateur band; there is some hope that this condition may be corrected and that some frequencies outside the amateur bands will be assigned to RACES.

Perhaps a better understanding of the RACES organization would be a comparison between it and the other amateur emergency organizations.

The AREC is an organization of radio amateurs sponsored by ARRL and dedicated to public service in emergencies by furnishing communications to or from a disaster area. It is not responsible to any public or governmental body except as it sees fit to acknowledge in the emergency. The greater part of its traffic consists of third party messages of the "Tell Aunt Mary that Cousin Lucy is OK" type. This is not meant to downgrade this type of traffic. It probably has done more to improve the "ham image" than anything else. What I am trying to express is the idea that AREC, in itself, is a private organization handling personal traffic in emergencies unless specific arrangements are made to handle some governmental messages.

MARS is an organization of radio amateurs sponsored by a military department. It is strictly responsible to the military and generally handles traffic of a military or military connected type. Rigid discipline is necessary and is generally enforced.

RACES is an organization of radio amateurs sponsored by the Office of Civil Defense within the Department of Defense. Its various levels are responsible to some level of government, local, State or National, and its members generally report to a Civil Defense Director at one of these levels. Traffic handled consists primarily of civil government messages although third party traffic of a more personal nature may be handled with permission if conditions permit.

From the above, perhaps over-simplified statements, you can see that the big difference in the three organizations is in the top control. Two are in semi-official capacities although manned by volunteers. All the MARS units have a mission of support to CD if it does not interfere with their primary mission. Many, if not most, MARS members belong to RACES and vice-versa.

The other big difference is that in a war condition only RACES frequencies would be available in the amateur bands. AREC operation would be cancelled, together with other strictly amateur operations.

Liaison and cooperation between AREC and RACES has been spotty. I believe this has been caused by the very luke-warm support of RACES by the ARRL Headquarters Staff. An example of this may be seen in past issues of QST in reports on AREC and RACES activities. AREC usually gets a page or so, frequently describing CD activities but reported under AREC news. RACES is lucky if it gets a paragraph. Reporting procedures are just not geared up to produce any different result at this time.

There are outstanding exceptions to the above. The Florida gang has the best disaster organization that I know about and there most of the hams involved belong to both organizations and function as one unit in disasters from the State level down to the local units.

There is very definite need for closer cooperation and coordination between these two organizations in most places. With more emphasis being devoted to improving the public image of the amateur, this appears to be one of the quickest ways to do it. At least it will help combat the image of the ham as "that fellow down the street who is always interfering with my TV."

Another point is this—if you don't want the CB boys to replace the hams in public service activities, it is up to you to do your part.

A prominent Civil Defense Director has written me as follows: (italics mine)

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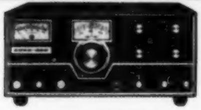

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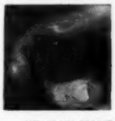

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from the local amateurs on tornado spotting, I brought the CB people in our county plan. They have been extremely cooperative, have developed their own maps of the county with their own grid system and have personally taken field strength measurements from all of the prominent higher altitudes throughout the county. They have also been very successful in having cooperation from those CB'ers not affiliated with us in remaining off Channel 20 when we are in a severe weather condition.

"I must stress the importance of RACES. This is a most opportune time to either augment or implement RACES operation by all Civil Defense Directors due to the emphasis being placed on PICAN because of the upcoming international radio-telegraph conference.

"I personally had a minimum response three years ago, I now have 48 RACES personnel operating on all three bands.

"In the less populated counties (ham wise) directors are still meeting *poor response from the local hams.*"

I quote this letter because the remarks are typical of those I have heard from other CD Directors in all sections of the country.

With the above background remarks out of the way, let's get down to cases. What can you do and how do you go about getting started?

First, see your local CD Director and volunteer your services for communications. If you don't know who he is, ask your Mayor or the head of your county governing body for his name and office address. Nearly all counties and cities of any size have CD Directors. Some are very active, some are not. The odds are that you will be greeted with open arms and welcomed as a desirable volunteer.

The Director or his communications man will explain where you could fit into *his* organization and tell you about his communications plan. Suggestions are usually welcomed but be sure you know enough about the problem to give intelligent advice before starting a reorganization plan of your own!!

What types are needed by CD? Any licensed amateur can be of help. Some locations cannot use hams under 18 years of age because of insurance or other reasons. I have never heard of a top age limit. Mature people, preferably holding higher grade licenses and having experience in net operations, are of course most valuable.

What types of emission are used? Generally 6 and 2 meter AM and/or FM are presently used for local operation. Some 10, 40 and 80 meter operation is used for longer ranges. AM and SSB, CW and RTTY are in use on these frequencies in various areas. Incidentally AFSK Teletype is beginning to be used on the higher frequencies for point to point work in many areas.

Are you legally obligated when you are accepted in CD? No, you are a volunteer only. You will not be paid, although you may borrow equipment from some of the more affluent areas for temporary use away from the Emergency Operating Center. This practice varies. You may quit when you desire but if you are the type who wants to "pick up his marbles and go home" when things don't go right, don't volunteer. CD needs people who can be counted on when the chips are down and who can submit to a reasonable amount of discipline.

Civil Defense is probably one of the least understood branches of our government. It is generally operated with a minimum staff and in most of its emergency operations will rely heavily on regular governmental departments such as fire, police, etc. Even these departments would in turn rely on trained volunteers to augment their forces in large disasters.

The weakest link in the average Civil Defense organization is in communications. This is normally a commercial function in this country and is handled by telephone and radio companies who are not usually under the control of any local government bodies. Few people in government have any knowledge of what constitutes emergency communications. And without communications there is no control, only chaos.

To paraphrase a famous remark—Don't ask what Civil Defense can do for you until after you have answered the question "What can you do for Civil Defense?".

Do some investigating, then help Civil Defense, help Amateur Radio and help yourself.

. . . W5CZ

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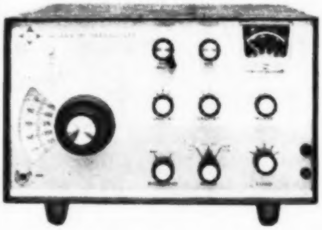

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Brussels International Mobile Rally

On the 22nd of September the International Mobile Rally organised by the Belgian Amateur Radio Society "U.B.A." in close co-operation with the Belgian Red Cross took place in and around Brussels.

This was in many ways a remarkable event. Firstly, it was a truly international event in which Mobile Radio Amateurs from Belgium, Holland, France, Germany and Britain took part. This was made possible by the generosity of the Belgian Authorities who were again willing to grant temporary mobile licenses to visiting Radio Amateurs from any country, irrespective of whether that country granted "Reciprocity" or not. This is the second time the Belgian and Dutch Governments have made this very generous gesture of International Goodwill (the first being for the Verviers Rally in April, 1963).

The Winner: ON4SN/M and SWL

Secondly, it should be noted that here were amateurs of several nationalities driving about a foreign country, on a crowded fine Sunday afternoon, operating their radios, map reading, following complex instructions in a strange country, and not a single accident has been reported nor a single infringement of either traffic or Radio regulations.

For these reasons alone the Rally would have been noteworthy.

But that is only an introduction.

The Rally itself, organised by U.B.A. whose President, Mr. Rene Vanmuysen, was responsible for the whole intricate organisation, began at a car park in the grounds of the 1958 Exhibition with ample parking space. Here each competing vehicle was issued with a carrier bag containing three envelopes. One to be opened at once, and the other two were S.O.S. envelopes to enable any competitor who failed to carry out all the instructions, to reach the ultimate rendezvous. These were issued in *four languages*—French, Dutch, German and English according to the nationality of the competitor.

The first instruction was merely to listen to the official U.B.A. Station, ON4UB, broadcast from 13.45 to 14.00 on 3.6 mc or 144 mc.

This broadcast instructed competitors in *four languages* to report to the parking place outside the church at Tervuren. This involved some map reading across Brussels.

At Tervuren a new envelope was issued instructing stations to call ON4VY for a code number. Thereafter they had to make five contacts with other Mobiles in the Rally and exchange the code number which each had received individually by radio before reporting to the church at Waterloo.

Here another set of instructions included calling the control station at Waterloo and exchanging a code number with the vehicle's own milometer reading.

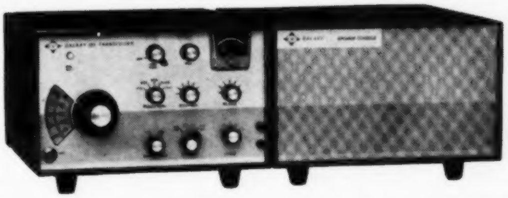
At Waterloo the occasion was taken to ask a number of questions to answer which involved a complete sightseeing tour of the historic items connected with the Battle of Waterloo.

It will now be realised that the Radio Rally was deliberately devised to take competitors through some of the most beautiful country around Brussels, including the Foret de Soigne, as well as visiting historic sites like the Battlefield of Waterloo. Furthermore, the questionnaires issued at the various control points asked questions which involved a far more detailed sightseeing tour than a tourist would otherwise have undertaken, including visits to the Victor Hugo monument, the Prussian memorial, etc.

Here at Waterloo the check point was at the famous farm the "Belle Alliance" where Wellington and Blucher met after the battle.

At each check point a new set of instructions awaited the competitor always beautifully duplicated in his own language.

Instructions included calling certain check points at certain places and exchanging num-



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bers, and exchanging these code numbers with other mobile stations during radio contacts as well as visiting many interesting places.

At the last check point a map was issued with instructions to return to Brussels and rendezvous at the Red Cross Headquarters.

Throughout the Rally the close co-operation between the Belgian Radio Club (U.B.A.) and the Belgian Red Cross was remarkable. The check points were manned by Red Cross personnel with Red Cross Mobile Stations. Red Cross personnel assisted with the parking and no difficulties were experienced in this respect at all.

Unknown to the competitors an emergency radio network was maintained with the Headquarters of the Red Cross in Brussels throughout the Rally on 157 mc FM. Had any accident taken place first aid could have been summoned immediately through this emergency radio network.

When we returned and rallied at the Red Cross Headquarters the cooperation between the two organisations was remarkable. Here the Red Cross provided the car park, the building and the hall for the prize giving.

U.B.A., the Red Cross and other Belgians had generously provided such a large number of prizes that the prize giving was quite a protracted affair.

Lastly, the Red Cross provided dinner for all the competitors and their passengers.

It is difficult adequately to express one's admiration for the work which Rene Vanmuysen, the U.B.A. and the Red Cross put into this remarkable venture, in which all instructions throughout were given in four languages, hundreds of envelopes prepared and so arranged to ensure that each competitor received his instructions in his own language.

As before, the end of the Rally was not the end of the fun. Our licenses had been granted to us for 14 days, both in Holland and Belgium, and there was still much operating and enjoyment to be had.

I, myself, had the pleasure of experimenting with an extension rod on the base of my Webster Bandspanner, suggested by W4TWW which improved my mobile reports very considerably.

Among the many stations worked from the mobile rig were—PY, LU, W, ZS6, CN8, 4X4, 5BX, ZB1, and such nearer rarities as—F9RY/FC.

The local contacts were also of major interest. After working a spot of DX near

Questionnaire

Please tear out this half page and send it in or put the answers on a separate letter or card. Just mark the appropriate letter(s) which answer each question.

1. Class of license I hold: Extra A; Advanced B; General C; Conditional D; Technician E; Novice F; none G.
2. My age: Under 20 A; 20-29 B; 30-39 C; 40-49 D; 50 up E.
3. Approximate investment I have in amateur radio equipment: Under $100 A; $100-$500 B; $500-$1000 C; $1000-$2000 D; $2000-$3000 E; $3000-$5000 F; Over $5000 G.
4. Number of years licensed: 0-1 A; 1-2 B; 2-3 C; 3-4 D; 4-5 E; 5-10 F; 10-15 G; 15-20 H; 20-30 J; over 30 K.
5. Modes I use: SSB A; AM B; CW C; RTTY D; NBFM E; WBFM F; TV G; Mobile H.
6. Bands I use fairly regularly (say once a week): 160M A; 80-75M B; 40M C; 20M D; 15M E; 10M F; 6M G; 2M H; 220 J; 432 K; 1296 L.
7. My main interests in amateur radio are: Rag chewing A; DX'ing B; QSL-Certificate hunting C; traffic D; CD nets & RACES E; building F; experimenting G; other H.
8. I read QST never A; sometimes B; regularly C.
9. I read CQ never A; sometimes B; regularly C.
10. I read 73 sometimes A; regularly B; devotedly C.
11. During the last year I have spent on mail order ham or surplus radio equipment 0-$9 A; $10-$24 B; $25-$50 C; $50-$99 D; over $100 E.
12. The Institute of Amateur Radio: I have joined A; I'm planning to join B; would join if it was less expensive C; don't care to join D; it should drop dead E.
13. My feelings about ham radio (select the closest): I'm all for it and am willing to devote a good deal of my time to helping it A; I'm all for it, but it is not important enough to spend much of my time on it B; great hobby, but let's face it, there are a lot more important things C; I'm supporting ARRL, let them worry about ham radio D; ham radio is just one of many hobbies, don't worry so much about it E.
14. The following purchases are contemplated soon: SSB transceiver A; receiver B; tower C; beam D; VHF gear E; test equipment F; transmitter G.
15. Mobile: none at present A; SSB transceiver B; 6M C; 2M D; AM E; WBFM F; near future G.
16. Club work: I belong to a local radio club A; I do not B.
17. During the next year I will probably spend on amateur radio equipment: under $100 A; $100-$200 B; $200-$300 C; $300-$500 D; $500-$750 E; $750-$1000 F; over $1000 G.
18. I have on hand catalogs from Allied A; Lafayette B; Heath C; Newark D; WRL E; B-A F; Harrison G; Radio Shack H.
19. 73 should have monthly columns on DX A; VHF-UHF B; RTTY C; YL D; propagation E; contests F; space G; transistors H; sideband J; clinic K; cryptogram L; TV M.

Waterloo from a place with the attractive name of Braine l'Alleud, we were called by ON4PZ who talked us into his home in Brussels, where we met his family and charming Vietnamese wife, as well as ON4AQ who runs a gymnasium, judo saloon and fencing institute and other physical culture activities in Brussels.

On another occasion we were called by ON4NJ who was located in a village called Wieze. This was some considerable distance from where we were at the time and we regretfully informed him we would not be able to call. Finding our batteries needed a bit of extra charging we cruised through the countryside without a particular destination and, to our great surprise, saw a signpost—"5-kilometres WIEZE." So, of course, we decided to call on our friend, ON4NJ, but we had forgotten to note his exact address and we did not think we would get there. However, a blind call on the frequency we had previously operated on the 15-meter band produced an almost immediate reply, and with great complication resulting from the one-way streets which had only just been organised because of the Autumn Festival (called "October Festival" though it takes place in September) we reached his house where we were made very welcome.

And so, when operating in a foreign country, one has all the pleasures of meeting the local radio amateurs in their homes in a way which would not otherwise be possible.

One must also remember that without the co-operation of the Belgian Government in granting licenses to all Radio Amateurs the whole event could not have taken place.

It should also be mentioned that the Netherlands Government were good enough to grant temporary mobile licenses to all amateurs passing through Holland to or from the Rally.

. . . G3BID

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The Callbook Game

It came to me the other night, after tuning around six and listening to a number of types trying valiantly to fit clever phonetics to their calls—and usually coming up with remarkably unmemorable duds—that one of the small but significant pleasures in this world is having a call which can be happily set to words. Something you can put a snappy phrase to, like what's-his-name does with Never Say Die for NSD, especially suitable because it fits his contentious nature so well. Or even Tall, Dark and Handsome, which may or may not be true, but is at least safe enough for me to use until ham television gets big.

Wouldn't it be nice, now, to have a call you didn't even have to think up phonetics for? Something ready-made like RAF, GMT, RFD, HCL (fora chemist), GOP, or BEM (this one may mean nothing to you, but a science-fiction fan would flip for it). Or even better, how about a word? Something nice and electronic like AMP or OHM, or maybe a name like JOE or BOB, or even something like EGG. All of which led me to what I call The Callbook Game, leafiing through that massive reference work to see if all those possibilities actually were calls, or whether the FCC had eliminated anything that could possibly have a meaning. I found 'em all, but while looking up one, my eye lit on another, and the hideous thought struck me—fine, fine, but what about the other possibilities, the letters that added up to something not so nice and innocuous as RAF or EGG. Like RAT, which I happened upon, and, looking further, ROT. Did the FCC let the bad ones through, too? And if they draw the line anywhere, then where?

I kept looking, and leafing, and found that the good old FCC has hardly drawn the line at all. Think of a wild combination, and there is is in somebody's call—BAM, POW, URP, UGH and ECH for the comic-strip fans. How'd you like to come on the air and say, "This is URP?" Or announce yourself with a call ending in APE, BUM, CAD, ELF, GYP, HOG or SAP? Or how'd you like to be a female operator and announce yourself as PIG? That one exists, by the way.

One coincidence led me to look for others. I'd found that nobody is an XYL because there are no calls beginning with X, which was something of a surprise. Neither does anybody have a Q-signal, incidentally, because the FCC hasn't let any calls through beginning with QS or QR—and these were the first deliberate omissions I found. But how about TEX; could anybody with that call be lucky enough to live in Texas? Nope, the only one in the 5-area lives in Oklahoma. But what about names? In all the eye-blearing looking I could stand when that idea hit me, I found no JOE named Joseph, no JIM named James, no BOB named Robert, no TOM named Thomas, no RAY named Raymond, no ART named Arthur, or anything. There was one very, very near miss—one DOO is named Donald, and how he must have cursed the luck of the draw when he got his ticket. Or was it luck? The coincidence of getting just the next call to a real wow seems too close to be true, but I couldn't help wondering if some killjoy down at the FCC doesn't watch out for such things, and pushed poor Donald's call back one space in the file when he saw it would have been DON.

All is not milk and honey with getting a meaningful call, I discovered as I sat thinking up peculiar three-letter combinations and paging through the call-areas to find them. There's SEX, SIN, SLY and so help me, PUS. And for initials there are KKK, TVI, FBI, and, so help me again, FCC. How'd you like to come on the air with that one?

After considerable thinking, and considerable more looking, I found that the boys in Washington seem to have drawn the line at a very few combinations, including such an innocent but understandable one as SOS, and a few of the more blatant obscenities which I can't even list here without getting the whole shebang banned from the mails. No doubt your own fertile imagination will come up with one or two that you won't find listed in the book. But the one's they've let through! Just think of any three-letter racial reference, for example, or even the best-known slurs, and you'll find them in somebody's call.

All of which led me to an interesting speculation. Namely, did the FCC even eliminate the worst of them, or did the unfortunate guy who got such a call just drop the idea of operating and never bother to renew the license because he couldn't bring himself to go on the air and announce himself with such a call. And what about some of the real doozers that are listed? I've never heard such a call on the air. It may be no more than statistical happenstance that I've never heard them, but I wonder if they, too, have dropped out.

Some calls, of course, are funny or obscene for no reason the FCC would possibly be expected to know, and wouldn't cause any problem in this country, but might get a little in the way of DX work. Anyone, for example, with the call ANO may have been having a little trouble making South American contacts and not knowing why—it's a vulgar word in Spanish, meaning exactly the same as another three-letter call beginning with "A" that the FCC has either eliminated from the list, or let through and then never heard from again in the way of renewals. And anybody with call PUD is going to get a lot of snickers when he tries to get through to England, for reasons I'd definitely better not go into. And whatever the terminal letters, a whole generation of WC2's—we're already half way through the alphabet on WB2's, if you haven't worked the "2" area lately—may have a bit of a problem in England, considering that W.C. is a standard abbreviation there for Water Closet, or john, or head, or whatever you may call it.

PUP, DOG, CAT, COW, ELK, HOG—the whole barnyard and pet world is there, and many, many more I haven't thought to look up yet. Have a look in the Callbook yourself. It's good entertainment on a dull evening when the band's dead and there's nothing better to do. I guarantee you'll find some dillies. Me, I'm waiting until a few more sunspot cycles have gone by and they've run all the way through WZ2ZZZ and start issuing the four-letter calls. Then I'm going to have some really fascinating reading!

. . . WA2TDH

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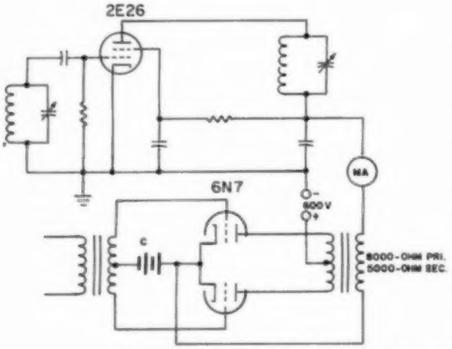
Plate Modulation with Controlled Carrier

Many amateur-type transmitters are marketed or home constructed for controlled-carrier modulation. All of these, however, seem to be of the "efficiency modulation" nature. That is, they achieve modulation by varying the efficiency of the transmitter to convert dc power into rf power. The fact that power-contributing or plate modulation can be combined with control of carrier seems to have been forgotten. Really, though, this form of controlled-carrier modulation is the oldest; it was described in the amateur literature some thirty years ago.



ADJUST C FOR APPROXIMATELY 15 MA RESTING CURRENT

FIG. 1

There is a real advantage in using "power modulation". The af power contributed by the modulator adds to the dc power from the power supply, thus producing additional strength of the information-carrying sidebands. Control of the carrier has two significant advantages. One is the reduction of heterodynes, the other is the illusionary increase in signal strength produced by the AGC action in a receiver. These two attributes have made controlled-carrier operation popular, despite the universal acknowledgment of the superiority of plate modulation.

In all systems involving the control of carrier strength, the main problem is devising a method of increasing the carrier power exactly as the audio voltage is increased, timewise and magnitudewise. Many schemes have been dreamed up; most of them miss the ideal by a considerable margin, as is amply illustrated by listening to such transmitters on the amateur bands.

The method to be described, as has been said, is not new. It does, however, present a means of increasing carrierpower automatically and in exact synchronism with an increase in af power. No time lag is involved in either the increase or the decrease of carrier magnitude.

As with everything, one does not get the desired end without paying a price. The price, in this case, lies in a requirement for a higher voltage power supply than one would use with a constant-carrier system. Another price is the limitation of its application to only transmitters using "Class B" modulators.

Let's see how it works. Suppose you're going to build a little radiotelephone transmitter using a 2E26 in the final, modulated by a 6N7. This would run around 15 to 20 watts input. In the usual case, you'd power this combination with a power supply delivering 300 or 350 volts. For this application, however, you'll need a power supply delivering 600 to 700 volts, for you're going to place your modulator in series with the 2E26's dc plate voltage lead! Please note that this is not a re-hash of the ancient system of plate modulation by audio-frequency variation of a resistive element in series with the plate dc supply. There's a difference! In this case, modulation is effected by the audio power from the 6N7 "Class B" modulator. The series connection, dc-wise, is there solely to effect control of the carrier strength.

Let's take a moment out to consider what we'll be doing. If you've operated a transmitter using "Class B" modulation you've no doubt noticed that the modulator's resting current is quite low. When you speak into the microphone, the current increases, varying with speech level. Because of the inertia of the meter, the current variations seem to "float" . . . to vary in a smoothed-out relationship with speech peaks. A bit of reflection, however, will show you that these variations actually follow speech levels precisely . . . no lag, no overshoot. Ah, now the idea develops! Why not let this current variation control the dc current of the modulated "Class C" stage? It is well known that the current in a series circuit is the same at all points. By placing the modulator in series with the "Class C" stage's power supply, we cause the "Class C" stage's resting current to be quite small. In fact, if we were to add a bit of C bias to the 6N7's grid, we could cut its (and the 2E26's) resting current to zero! There are sound reasons, though, why we don't want to overdo a good thing; we'll let a small resting current flow. But when we speak into the microphone, the 6N7's and the 2E26's plate current increases in exact synchronism. No over-modulation on even the first few cycles of voice-frequency audio, no hangover of strong carrier as the voice drops off!

Let your eyes roam over to Fig. 1, which depicts the circuit for a 6N7-2E26 combination. You'll see it's a very conventional circuit, differing only in the series (dc-wise) connection of modulator and modulated stages. The same circuit can be used for almost any final and modulator.

If you want the advantages of plate (power) modulation and the feeling of having done your part in reducing the number of useless heterodynes that infest amateur radiotelephone bands, build a transmitter incorporating this time-tested feature.

. . . W5EHC

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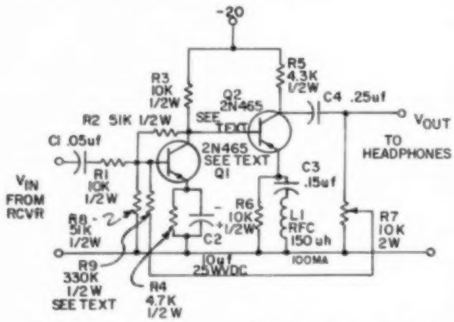
Audio Bandpass Filter

Some electronics companies are now advertising that they use digital computers to design their filter networks. For the ham who needs a very selective audio bandpass filter, but does not possess an IBM 650 and can't afford ten bucks for a high quality audio inductor, the following equipment is described. It is a two-stage transistor audio amplifier with a series resonant LC circuit in the forward loop, and uses positive feedback to increase the Q of the cheap and dirty tank circuit to as high a degree as might be desired. Its input is plugged into the headphone jack of the shack receiver, and the op's phones plug into the amplifier output. At a bandwidth of 80 cycles it has a peak gain of 20 db, and for slow CW signals (and there are some on the novice bands) the bandwidth can be decreased to the limit of intelligibility. Just for fun, the author increased the feedback to just short of instability, and measured a 3db bindwidth of 3.5 cycles at a center frequency of 1070 cycles. Made the signal sound like someone "strummin' on the ol' banjo", but it just shows what the little thing can do.



The schematic shows the design to be fairly conventional, as far as the two amplifier stages are concerned. The power supply is a 22½ volt battery, current drain being only 2½ mils. The first stage is rather stiffly biased, and uses negative voltage feedback from the collector to the base. This serves to improve gain stability, and also to reduce the output impedance of the amplifier, thus improving the power transfer to the succeeding stage, which near resonance has a low impedance input. The emitter resistor of the first stage is heavily bypassed, which tends to make this stage have a low input impedance. Coupling from the input is through a capacitor and series 10K resistor, which simulates pretty well a head phone load on the communications receiver.

The base of the second stage is tied directly to the collector of the first, thus simplifying bias and coupling. Note that the emitter resistor of this stage is paralleled by a series capacitor and inductor (150 millihenry rf choke). At frequencies far removed from resonance of the LC combination, the emitter impedance of the second stage is essentially the emitter resistor, but near resonance the impedance of the series LC begins to drop. Thus, near resonance, the low series impedance of the tank predominates and the flow of base current is increased, assisted by the low output impedance of the first stage.

It will be noted that two 180 degree phase reversals take place in the amplifier, one in each stage. Thus, the output voltage, taken from the collector of the second stage, is in phase with the input voltage, and the feedback from the pot through the fixed resistor is regenerative. In essence, this means that as more signal gets through the amplifier, more is fed back, and since the gain of the amplifier increases near resonance, due to the series LC circuit, the output voltage rises sharply near resonance. This is what transforms a low-Q circuit into a highly selective audio amplifier.

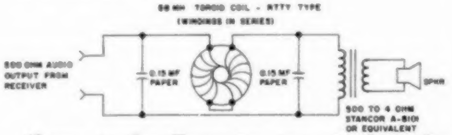
Construction is straightforward. Parts layout is not in the least critical, and considerale latitude is allowed in the transistors. In fact, almost any low power audio transistor can be used. The only component which requires care is the fixed feedback resistor. Values should be tried until one is found which just produces oscillation when the pot is fully advanced to the maximum feedback position. Thus, when you're ready to operate, plug the amplifier into the phone jack of the receiver, the headphones into the amplifier output jack, and advance the regeneration control until a whistle is heard. Back off a bit, and you're in business. . . . Hansen

SSB Audio Filter

Have you ever noticed the amount of high frequency "garbage" or "monkey chatter" that seems to show up when you use a loudspeaker when listening to SSB signals? High frequency, adjacent-channel buckshot and howls tend to make life miserable, and will drive the operator back to headphones having a restricted audio response in many cases.

This annoying high frequency response occurs in even the best of receivers and is often due to unwanted components that "sneak around" the selectivity determining circuits of the receiver. Rejection of your receiver to unwanted energy six or seven kilocycles away from the passband might be of the order of fifty or sixty decibels; but when a strong signal many, many decibels above S-9 is adjacent to your listening channel, some energy cannot help but "leak around" the passband unless your receiver has an unusual (and expensive) *if* rejection system.

You can help solve this problem in two ways: The expensive way is to rebuild or otherwise modify your receiver to reject signals in the adjacent channels, or you can make up a low-pass audio filter that will prevent the adjacent channel "garbage" from reaching your ears. This second solution will cost you about a dollar. It will not reject interference in your communication channel, but it certainly assists in killing QRM that often "leaks around" your *if* system.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0.15 MF PAPER
0.15 MF PAPER
SPKR
500 TO 4 OHM STANCOR A-8101 OR EQUIVALENT

Shown in the illustration is a simple audio filter designed to cutoff at about 2500 cycles. It should be placed in the 500 ohm audio line between the receiver and the speaker. The inductor is a 88 millihenry toroid coil, beloved by the RTTY gang, and availabl from many sources. The two windings of the coil are placed in series and the coil may be mounted to the inside wall of the speaker cabinet. If the cabinet is metal, space the coil away from the wall about ½-inch by means of a long 6-32 brass bolt and two rubber washers.

It will take you about five minutes to make up this simple filter. Used with a Collins 75A-4, it makes an impressive reduction in the amount of high frequency "monkey chatter" in speaker reception, and makes sideband reception on the speaker a pleasure instead of a chore. . . . W6SAI

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Connectors Mounted on Back

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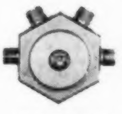
MODEL 550A

Connectors Mounted on Back

MODEL 590

Connectors Mounted on Side



Models 551A and 591 are 2 pole, 2 position special purpose switches with UHF type connectors. Designed for switching any RF device in or out of series connection in coax line circuits.

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Correcting the Errors in the Errorless RTTY Converter

Jim Kyle K5JKX
1236 N. E. 44th
Oklahoma City, Okla.

Since publication of my "Errorless RTTY Converter" (page 12 September 1963 issue of 73) I have been deluged with letters from the RTTY gang. Some have come from as far as VK land. It's encouraging that so many people are interested in the thump-and-bump techniques of communication—even though 99.9 per cent of the letters asked the same question: "I've built it now how can I make it work?"

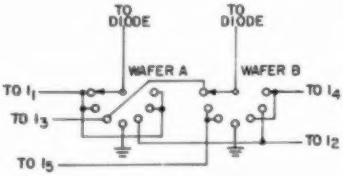


FIG. 1 CORRECT SWITCH WIRING

If ever a project were misnamed the "Errorless" is that project. For a while it appeared that the whole thing was one major error on all our parts. But when the basic trouble was tracked down it turned out to be simple (though highly improbable). The question now is "How did that one fellow get his to play?"

The original Errorless was more or less pitched together out of the junkbox and it seemed to be so uncriticial that the normal "tolerance tests" (switching tubes around, etc.) weren't made on it. Never again. I haven't calculated the odds against this happening again, but two of the three 12AX7's used in that model were slightly defective. If they hadn't been, it would never have played. So naturally, when all the rest of the gang built them up with good tubes, came trouble.

Just to complicate matters, the schematic itself with the original article contained three errors. Any one of them would bollix things up in a large way. Before we get into the major problem, its cause, and its cure, let's get these little things out of the way.

The first error was omission of a 100K resistor from the "switch" side of I1 to ground. Without this resistor, I1 has no ground path and cannot ever light. This, in turn, locks the converter in the non-print condition on switch positions 1, 2, 6, and 7, for the "fictitious" signal required in these positions won't be present.

The second error was in the switch wiring. Since the original schematic included no reference designations for the switch wafers or terminals, a corrected switch schematic appears in Fig. 1. The error was a transposition of wires between terminals 5 and 6 of Wafer A. This error made bilateral copy of mark-high signals impossible, and left you copying from space signals only on positions 5, 6, and 7. Since 5 and 7 were already dead because of the omitted resistor this meant that the only switch positions which would allow operation were 3 and 6.

The third error was in the value of the resistor from V5's grid to ground. Instead of 56K, it should have been 22K. As drawn, the output Schmitt wouldn't trigger. Adding a 47K from screen to cathode on V5 improves triggering reliability, and lets us discard the 100K 2-watt Zener "keep-alive" resistor also.

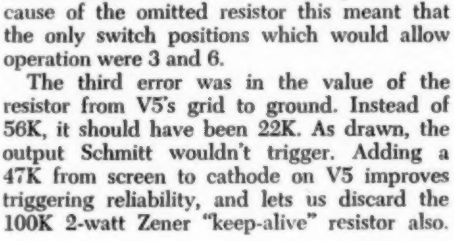


FIG. 2 CORRECTED CIRCUIT FOR V_2 AND V_3

With these three errors corrected, application of +30 volts across the neon-load resistors flips the output trigger and lets the printer magnet drop out. Any voltage less than +20 here holds the magnet in, with up to 75 ma current. Current can be reduced by making the screen voltage for V5 lower.

Now let's go into the big problem. The plain truth of the matter is that, as published, the V2 and V3 Schmitts won't flip. As I said, I don't know what the odds against its happening again are, but I imagine somewhat greater than those against drawing three cards to fill a royal flush, or being dealt a perfect bridge hand. But it appears that both my 12AX7's were slightly gassy, just enough to get a semi-thyration action, letting them work in the circuit.

The first dozen or so who wrote about this were advised to add positive bias to the input grid, making it easier to trigger. My apologies go out to everyone who tried this quick and simple "cure" because that didn't work out either. Finding the real cure for the situation took quite a bit of breadboard experimentation. In the middle of it all, W9QAZ dropped in for the specific purpose of finding out how this thing was supposed to work, and he helped quite a bit in the later stages.

Between us, we came up with not just one but two cures. One uses most of the published circuit intact; the other requires that virtually every component value in the circuits of V2 and V3 be changed, but gives vastly increased switching sensitivity. You can take your choice.

The little-change cure requires that the dc connection from the detector output to the input grid be broken, and + 30 volts bias be applied to the grid. In addition, the 10K cathode resistor must be replaced with 21,300 ohms. To get this value, use an 18K and a 3300 in series. The resistance value was found to be critical within 100 ohms for positive switching and good sensitivity. 22K wouldn't switch, and 20K required an input signal of approximately 40 volts peak-to-peak.

With 21,300 ohms, and the 30-volt positive bias, a 4-volt peak-to-peak (about 1½ volts rms) signal from the detectors gave positive switching. Plate voltage was also found to be reasonably critical, and was regulated at + 210. Operation was still obtainable at voltages as low as + 175 or as high as + 225, but again sensitivity was lowered.

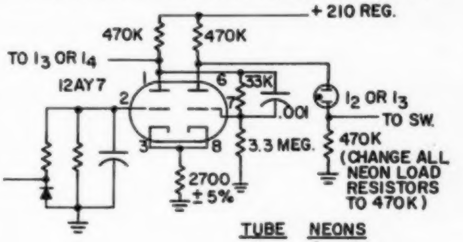
The final, and most important, circuit change for this approach was to replace the 12AX7 with a 12AU7. The 12AX7, when in good condition, was found to be unsuitable for this circuit!

The changes required for this approach are shown in Fig. 2. Values not indicated are unchanged from the original circuit.

After discovering that the 12AU7 worked much better than the 12AX7 in the hookup, I set out to test all the twin-triodes of this general type which I had available. The 12AT7 was found to be usable though not particularly good—but the 12AY7, a not so well known tube, came out almost perfect. It was employed in the high-sensitivity version.

The schematic for this circuit appears in Fig. 3. Note that the positive grid bias is no longer necessary when using the 12AY7 and the changed resistance values. The trigger remains "off" so long as input voltage is less than 100 millivolts, and switches "on" with positive action as input passes 300 millivolts. It returns to "off" when the voltage drops below 200 millivolts at the end of the mark or space tone.

To get this remarkable sensitivity, the plate supply once again was regulated at + 210 and the cathode resistor was found to be fairly critical at 2700 ohms. A standard 5 per cent resistor can be used, however, with no worries. Raising cathode resistance to 3300 ohms merely reduces sensitivity slightly, to 2½ volts.



TUBE	NEONS	
V_2	I_4	I_5
V_3	I_3	I_2

FIG. 3 HIGH-SENSITIVITY FOR V_2 AND V_3

A few of the gang have inquired about the filters used ahead of this unit. As mentioned before, almost anything can be used. The filters referred to in the original article were described in the November, 1962, issue of 73 by W3TUZ on page 32.

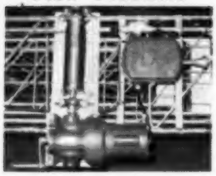
Most people want to know more about the 33-volt Zener. It should be rated for at least 10 watts. One such Zener, manufactured by many firms, is the 1N2990. Don't pay extra for an A or B suffix; these indicate tighter tolerances, rather than a newer model as they would in vacuum tubes. This unit sells for about $5 most places, but Lafayette Radio lists a Dickson Diodes 1N2990 in their 1964 catalog for less than $4.

Not mentioned in the original article, because I hadn't discovered it at that time, is the fact that power-supply voltage should not be allowed to exceed 300. The output trigger works nicely a 250 volts, and if you build up a supply for the unit 250 would be the best target to shoot for. When the voltage rises as high as 310, the output trigger locks up and won't drop out on space!

Despite the errors involved in the original article, the unit itself still qualifies for its "Errorless" name. If you can tell a signal is there, this gadget will give you the cleanest possible copy of it. So, as I said the first time, happy digital RTTY!

. . . K5JKX

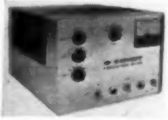
New Products



Rohn Automatic Winch

Rohn has announced a new motorized winch for its H.D. Series Crank Up Towers. The winch unit consists of the winch, a heavy-duty weather-proof motor and gearbox, and the Rohn Model 100 Tower Controller. The complete unit is wired at the factory and is supplied with 25 feet of two conductor power cables. Two connections to a 115 VAC 60 cps source are all that is required to ready the tower for operation. The Rohn Model 100 Tower Controller is contained in a cast aluminum weather-proof housing that is equipped with a lockable latch. The housing is also equipped with a screened vent to prevent moisture accumulation within the housing due to temperature changes. The control panel contains the control circuits switch which allows all power to be removed from the circuits for safety while working on or around the tower, fuse protection for the control circuits, indicator light for power and fuses, reset device for motor protection and momentary contact pushbuttons for controlling the up, down and stop functions of the tower. Limit switches are utilized to prevent damage to the tower through excessive up and down limits of travel. They are weatherproof and contained in cast housings to assure long life and reliable lock operation. Ready access is obtained to the Tower Controller by the removal of just four screws. The control panel may be moved aside for access to wiring and terminal strips.

The Rohn Model 200 Remote Control Unit, an added optional feature, enables the operator to control the tower from a remote point with all the ease of local control with the added convenience of a tower height indicator. The remote control unit is equipped with a key-operated power switch, indicator light, momentary contact pushbuttons for controlling the up, down and stop functions of the tower, lights indicating direction of tower travel, height indicator and calibration switches to set indicator to read elevation of tower or antenna top above ground level. The motorized winch unit is supplied with a hand crank to allow the tower to be raised and lowered manually in case of power failure. Whether operated from the base of the tower or by remote control, the new Rohn Motorized winch adds new ease, convenience and accuracy to controlling tower height for the amateur and the experimenter, and is provided with all the assurances of quality workmanship, superior design and functional capabilities inherent in the Rohn line of towers and accessories. For complete information, contact the Rohn Manufacturing Company, P. O. Box 2000, Peoria, Illinois.



Gonset Finals

Gonset has 2 new VHF finals you ought to investigate. They are designed to operate as Class AB$_1$ linear amplifiers providing 200 watts output, or as non linear Class C units handling 280 watts output on 6 or 2 meters. Under Class AB$_1$ operation the units may be employed for SSB, AM, CW, MCW, FM and FSK service, and in Class C operation for FM, PM, and CW service. In addition, they both have frequency ranges (model 903A–144-148 mc, model 913A–50-54 mc), that extend well beyond the amateur bands, permitting the application MARS, and CAP, and other military frequency allocations. On special order, rf amplifiers to cover any segment of the frequency range from 1.6-500 mc are available.

The new Gonset RF Power Amplifiers are also equipped with all necessary supplies and are rated for continuous commercial and amateur service (CCAS). The high voltage supply incorporates a solid-state bridge rectifier composed of 24 800piv-750ma, controlled avalanche diodes for high reliability. The unit also employs a husky solid-state 400piv-500ma diode in the bias supply. Both amplifiers have been designed as ideal companion units for Gonset's 2-meter Sidewinder and the new Gonset 6-meter Sidewinder, or any of the Communicator series and any other exciter capable of producing at least 5 watts. Attenuator pads are available if needed. For more detailed information and specifications write to Gonset, 1515 S. Manchester Avenue, Anaheim, California.

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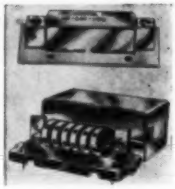


Lafayette Mechanical Filter

Lafayette Radio Electronics Corporation has introduced a highly selective mechanical filter for use in amateur, cw and ssb communications receivers. With the influx of new stations and narrow bandwidths prevalent today it is necessary to increase the selectivity of present receivers with an intermediate frequency of 455kc. The Lafayette mechanical filter closely approximates an steep-skirted, flat-top ideal band pass response. At 2.5 kc on either side of the center frequency, the filter provides 60 db attentuation of unwanted signals assuring complete adjacent channel rejection. With the mechanical filter comes a network consisting of two coupling transformers mounted on a PC board only 2¾W × 5/8H × 1 3/8D. Price is $19.95. Full Specifications are available on request from Lafayette Radio Corporation, 111 Jericho Turnpike, Syosset, L.I., N.Y.

New Heathkit 6 & 2 Meter Converters

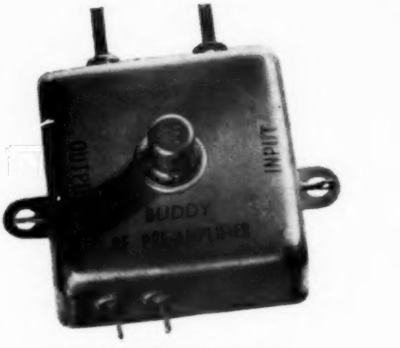
The Heath Company, Benton Harbor, Michigan, has announced the availability of two new 6 & 2 meter converters to extend the operation of the Heathkit Model SB-300 SSB Receiver for high performance VHF Reception. Both models can also be used with any receiver providing appropriate voltages and 10-meter coverage.

The 6-meter model, Kit SBA-300-3, extends coverage of the SB-300 Receiver from 48 to 54 mc (50 to 52 mc with crystal supplied), and the 2-meter converter, Kit SBA-300-4, extends coverage from 142 to 150 mc (144 to 146 mc using crystal supplied).

Both units are easily installed on the SB-300's rear cabinet panel with simple plug-in connections and power cables. One switch activates either converter.

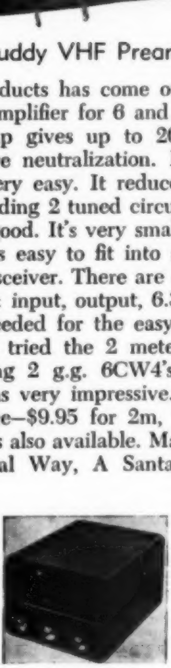
In addition, each converter uses a 6DJ8 cascode amplifier for low noise factor and high sensitivity and there's an applied AGC provision for strong signal handling capability.

Each converter sells for $19.95. For full information, write the Heath Company, Benton Harbor, Michigan 49023. A free 108-page catalog describing the converters, as well as over 250 Heathkit products will be sent your way.



Buddy VHF Preamp

Marina Products has come out with a new Nuvistor preamplifier for 6 and 2 meters. The Buddy preamp gives up to 20 db gain yet doesn't require neutralization. Frequency adjustment is very easy. It reduces spurious responses by adding 2 tuned circuits where they do the most good. It's very small (only 2 × 2 × ⅝ in.) so is easy to fit into almost any receiver or transceiver. There are only 4 connections to make: input, output, 6.3 vac and B+. Everything needed for the easy installation is included. We tried the 2 meter model on a converter using 2 g.g. 6CW4's and the improvement was very impressive. Best news of all is the price—$9.95 for 2m, $8.95 for 6m. A CB model is also available. Marina Products, 2912 Industrial Way, A Santa Maria, California.



Lafayette VFO

Lafayette Radio has introduced a new self-powered VFO covering the 80 through 10 meter amateur bands. The 99-2501 VFO uses a high "Q" series tuned Clapp oscillator with a VR tube to eliminate frequency shift due to line voltage fluctuation. There are two output impedances and output is sufficient to drive most modern transmitters. It features a large easy-to-read illuminated slide rule dial with a smooth tuning drive. The power supply uses silicon diodes and operates on 117 vac. tubes: 6AW6, 6AQ5, OA2. Dimensions: 6½W × 5¼H × 7½" D. More information is available from Lafayette at 111 Jericho Turnpike, Syosset, L. I., N. Y.

New Literature

Mobile Handbook

Sams' new book, the *Two Way Mobile Radio Handbook* by Jack Nelmi will interest anyone who works with mobile radio. The table of contents indicates the thorough coverage: Basic Systems, Receiver and Front End Circuits, IF Systems, Squelch and AFC, Transmitters, Control Systems, Antenna Systems, Power, Servicing, Setting up the Shop, Sales and Service, and Common Carrier Service. The book is written in Sams' usual clear style. Price $3.95 from your dealer or from Howard W. Sams, 4300 West 62nd Street, Indianapolis, Indiana.

Mobile Interference Book

Bothered by interference in your boat or car? Hallett Manufacturing Company has a new book available that describes the sources and elimination of interference to mobile rigs. In an easy to understand question and answer style, the book will help you discover what is causing interference and how you can use suppression kits, filters and shielded ignition systems to prevent it. This informative book was written by Robert McIntosh, the president of Hallett and is free to anyone using, selling or servicing mobile gear. Write to Hallet Manufacturing Company, 5910 Bowcroft Street, Los Angeles, Calif.

Writer's Handbook

Anyone who wants to write for 73 (or any other technical magazine) should read the *Technical Writer's and Editor's Stylebook* carefully. It will help to improve the clarity and grammar of your writing and will show you how to prepare manuscripts that will not give us fits. The well-known author, Rufus Turner K6AI, covers the basics of technical writing, manuscript preparation, grammatical construction (the way it should be taught in schools), punctuation, use of math, etc. Also included are a number of tables and glossaries that will prove very valuable to any writer. It's published by Howard W. Sams, 4300 West 62nd Street, Indianapolis, Indiana. Price: $3.95 softbound, $4.95 in hard covers.

Tri-Ex Catalog

Tri-Ex Towers has a new catalog out. It includes all of their fine products, such as ham and industrial crank-up and tilt-overtowers, motorized crank-up towers, rotating towers, guying accessories, communications towers, economy towers, tower trailers, brackets, standoffs, etc. Just about anything you could possibly imagine in towers and related gear is included. Write to Tri-Ex Towers, 127 East Inyo Street, Tulare, California and they'll be glad to send you one.

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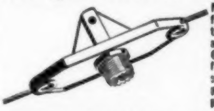

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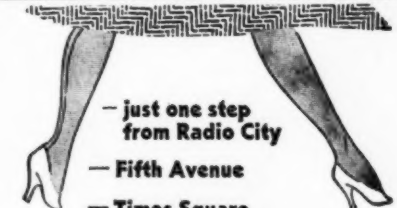

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Letters

Good morning, Wayne,

Played at the Richmond Radio Club Friday night was a tape of a debate between John Huntoon and yourself at a convention of some sort somewhere in New England last Spring. This was sent to WA6UFW, who thought of the idea for a similar debate out here back with the Pacific Division Convention in September. Since Huntoon and other West coast prominents of the League refused to debate with such a scurvy character as yourself, Don bugged Huntoon about it at the Convention. Huntoon's excuse was that another debate would be useless, since it would probably turn out like the one in New England. He offered, instead, to send Don a tape of that debate.

Well, after listening to that two hour tape, I can see why Huntoon was not anxious to have it repeated! I am curious a to why he even sent it to us in the first place; it sure did not seem to represent a "victory" for the ARRL.

One more thing about the December 73, where can I get a wall clock like the one on page 56? Is it a half-sized clock for crowded walls, or does it go from 1 o'clock to 48 o'clock, for weekend contests?

Bob Suerstedt, WA6VAT
1867 Van Ness
San Pablo, Calif.

Dear Wayne:

It seems we amateurs are critized for not doing enough public service. However I believe a lot of hams hide their light under a bushel and I would like you know what the "Old Pueblo Radio Club" is doing in Tucson.

Phil Richardson K7OBS has been meeting the Eye Bank here for quite some time and will now be assisted by Skip, K7DHD and Tom, K7RME. The Eye Bank Net reports that by October 10, 1964, five hundred eyes were exchanged. Skip, K7DHD recently received some nice newspaper publicity for his work in the eyebank.

Phil, K7OBS was instrumental in getting our club a permanent meeting place from the city and we will also get a special room for radio equipment and as a shop for construction. As Phil also manages Radio Station KTKT we get extra publicity there. An SSB transceiver has been purchased. We are also incorporating to protect the officers and members. Ham-TV may be included.

Club projects are as follows. Code and Theory instruction. The newspapers gave us some publicity with the result that between 135 and 140 persons showed up for registration. And at the fourth session we had between 80 and ninety still attending classes.

Under Edil, K71CK, leadership, John, K7JQJ is teaching advanced theory Chet, K7VYF and Tony, DL6UK is teaching code with the assistance of Dave, K7WMA, Mark K7OLZ and John, K7VZB, Huddy, W7QNC has worked hard and been at every session. He is our present president and K7OBS is vice. Pres.

The big project of the year is "Operation 52." This has been in effect for several years and is certainly a public service project. Each year the parents of each child at the Asthmatic Foundation here is contacted and effort made to have a ham in that city furnish a phone patch so that each child may talk to it's parent on or at Christmas time. This year it will be 26th and 27th of December. "Skip," K7HDH will be co-ordinator of Operation 52 this year.

Outside of this we have had some very good speakers at various meetings in the past and in September we had an ATV demonstration with two complete stations.

I feel that the above gives some of the other clubs something to shoot at. My own projects have been handling some traffic and drumming up interest in ATV and UHF.

Al Johnson, K7VQI

Dear Wayne,

One thing which you may know, but that some of your readers may not—the Army offers a eries of correspondence courses in electronics which are very thorough, free to members of the Army Reserve and I think to people in MARS also. These courses range from mathematics and use of the slide rule to SSB, transients and wave forms, pulse techniques and so on. From those courses I have taken, I can say that they are excellently presented, and that the questions and exercises at the end of each lesson really help the material to stick after you've read it. I have found that just buying books on electronic theory can be a sad experience. Either the book will quickly sail off into higher mathematics and leave me far behind, or else it will be full of little figure drawings of Vicky Volt and Andy Ampere on their merry electronic way. The Army courses offer a good compromise and can provide the sort of technical background that a ham can really use. Information on how to apply for these courses can be obtained by Reservists at their local reserve center. The reserve center will also have a catalog showing the courses available. They are offered both by the Signal Corps, and the Army Security Agency.

One other thing, hams of draft age shouldn't overlook the chance to learn something about their hobby while they serve their time. Being a radio operator or a repairman can be a much more enjoyable way to spend a few years than woofing around in the mud with a rifle. Not only the individual benefits from the training he receives, but the service benefits also from having a man who has prior experience and some interest in his work. Also the ingenuity for which hams are famous often leads them to solve problems which more dogmatic types can not handle.

Well, I guess that's about all. I envy you, living up there in New Hampshire. I have climbed Mt. Monadnock three or four times and have done some work for a person with a summer home near the bae of the toll road. There's an awful lot of nice real estate up there.

Alan Tompkins
New Haven, Conn.

Hi!

You sure built up 73 magazine since the first few years. Congratulations. The XYL and I visited you the day you got your horse . . . remember? I'm through with QST. Don't need it at all. They still have the old attitude, "Father Knows Best." I like your down to earth editorials. QST is too big for its breeches. An organization for the interest first of the QST brass, then the interest of the ham. Keep up the good work.

Fred Haas W2SF
Bronxville, N. Y.

Dear Wayne:

Congratulations to I.O.A.R. for the fine flaming decals designating the founding members. We certainly will use them with pride. Also we consider the publishing by I.O.A.R. of FCC Part 97 Rules and regulations for its members a great service. This is the first time we have had them available for reference in a suitable form that can be filed for quick reference should we desire and many questions come up most daily that need them for reference. I assume that the I.O.A.R. will also keep its members advised of changes when they become effective.

We are of the same opinion as you that the more readers of 73 we have the more interest will be taken in the preservation of our hobby. (Don't let ARRL hear me call it a hobby.) Huntoon broke down and wrote me a letter asking me to rejoin the ARRL. I shall consider it. However, that seems to be the only way that I could get a letter from them as they would not answer mine while I was a member, HI.

IOAR's organizational chart and the report on the funds were informative and of interest to me and I appreciate this personal attention. I certainly hope that IOAR never gets so large in scope that its members become numbers to denote power for your office to use, as has been the case in others, HI.

Ted Ames K1VHT
Millinocket, Maine

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Dear Wayne,

Over the June 5-6th holidays there will be a very, very big German Ham Convention in Berlin held by DARC. The mayor of Berlin (and possibly the next Chancellor of Germany) Willy Brandt will be sponsoring the event. We will have about 2000 hams in our city. Delegations from England, Sweden and Switzerland have already announced their participation. There will be a grand opening at the largest studio hall of Radio Free Berlin, exhibitions of all kinds by manufacturers and stores on the fair ground at the Funkturm, meetings for different divisions of our hobby (DX, YL, VHF, etc.), hidden transmitter hunts, a BIG hamfest (two bands and variety program), a tour of both sides of the city and more.

A few words of comment on the war between the ARRL leaders and Green. Much of it is of little interest to German hams, e.g. incentive licensing, dictatorship, etc., but from what I hear, hams in DL do not generally think that the ARRL is exercising good leadership for the good of international hamdom. I think the ARRL could do much for the ham by working up a general prodecure to be used in all countries to influence the respective governments in our favor. Lobbying is badly needed on an international basis just for the sake of survival. This is a tough problem since, particularly in the newer countries, you don't have but a few hams and they have little or no influence on their governments. Commercial radio and communications services are the greatest threat to amateur radio and this situation should require every effort of all hams everywhere.

I don't want to go into details on the accomplishments of the ARRL during recent years or the recent proposals, etc. To a foreigner most of them are of no interest or even seem ridiculous. Has anyone thought of starting an international training program for hams? Sure, it would cost money, but it would be money well spent. Like for instance the Hudson Amateur Radio Council might sponsor a three year training program for hams in the newly independent Balumbumbia instead of wasting their time and dough on that K2US fiasco. Or the Florida boys might help hams in Iran set up an emergency net for communication after those earthquakes they have there.

Wayne, you take over from there. Maybe my ideas can give you and your "enemies" something to talk over. And maybe it would give CQ a chance to give the money they owe you to a good cause. I'm sure you wouldn't mind.

Pete DL7EU
Berlin, Germany

Dear Wayne,

I've been reading with interest, the controversy as regards the ham bands, FCC, ARRL, and the Geneva Conference coming up with the attendant possibility of reallocation of bands, stiffer tests, etc. I think hams should be limited to 50 watts, the lower frequency bands taken away entirely . . . Rather abrupt, too drastic, you say? Remember, "What have you done for me recently?"; this applies to hams today. What have they done for radio recently?

I'd like to sketch a little personal picture for you to elucidate the above. I'm a mechanical engineer who decided, because of automation, to study industrial electronics at night and pick up an asociate degree. When I finished, I decided to use this knowledge for personal a well as professional use. I took the Novice and Technician exams in 37 minutes—they're too easy. I bought a 15 watt transceiver to "get on the air with," bought a BC-645 to convert for 420 mc, an SCR 522 for 2 meter, started converting, built a beam, 6 meter and 2 meter converters; after a couple of months on the air, everything came to a "screeching halt."

I joined a club, "York Road Radio Club," and found the group more interested in parliamentary procedure and how to attract new members than winding coils or building equipment. The president actually bragged about a friend bringing a 675 watt 6 meter transmitter to his house every so often to, in his words, "Wipe out tv in my neighborhood." (He didn't like his neighbors). Obviously, I quit since I seemed to be a minority there. I joined AREC, and the first time I monitored our local frequency, I heard a couple of kids pettishly complaining about a commander usurping a coordinator's authority (or vice versa). I don't think the roll was even 30% complete during the 3 or 4 nets I monitored.

I joined MARS—there's a serious business—the members join to get equipment and if you talk about service and duty, you're laughed at. After I chalked up about 12 roll calls, I could see why: the extent of traffic was "Mom: I'll be home Saturday at 7:00," or some such equally important message.

When I got my license, I was full of enthusiasm for ham radio: now, after a year and a half, I've concluded that ham radio is overrun with "B.S. merchants" who have no interest in ham radio as a "service," nor in electronics technology. (The CBers did more in N. J. during a recent forest fire than hams.)

If this seems like a scathing attack on hams generally, I don't mean it to be, but dammit, it's certainly an indictment of the segment I've contacted so far.

I haven't even mentioned the slobs that go buy a 2000w PEP sideband rig and don't even know (or care) what's inside, the clowns who make contacts just to count QSL cards—who hardly stay with you long enough to find out if they can talk about ham gear intelligently, the lovable fellows who won't even answer you if you don't pin their S meter when you call or answer them, the idiots that really spout the "jargon" like professional radio announcers, but lose patience if you're interested in specific equipment info: these are the lesser lights.

Now, I'm not a child (36), not stupid, (I'm proficeint in two areas; "mechanical engineering" and "electronics"). I certainly have no personal reason to pick on hams, and these are my honest feelings. My recommendations to my congressman are: relegate hams to the UHF bands, open up more CB, lower max power, let > 1 watt transmitters operate unlicensed in all ham bands, let the license level (with attendant test) determine max power, retest every 5 years with renewal.

In conclusion, if my experiences had been other than I've outlined, I'd still feel that hams can do just as much BSing at 1500 mc as at 14 mc, learn more by havnig to cope with the UHF wiring and propagation, and do a greater service to the general population (who are still the majority) in opening up these bands. Ham radio is a hobby, but since it utilizes publicly owned property, the radio bands, hams have a real responsibility to the people who have allowed them to use this property. Are they meeting this responsibility today as hams did in the past? I doubt it—

Robert R. Shue K3YEW
Willow Grove, Penna.

Yes Robert, many of us have run into the situations you describe. The solution to these problems really isn't to take operating privileges away from everyone as you, and the League, propose. Your quitting the radio club did more to weaken amateur radio than the irresponsible president for you, if you'd worked at the problem, could have gathered together the more thinking members and gradually gained enough influence to guide the club progressively. I've run across the same situation many times. Sure, sometimes it takes a year or two to get things straightened out, but you have reason and reasonable men on your side and you can't lose. The same thing goes for the AREC and MARS. While a few of these nets are toys in the hands of children, some quite old, most are run by serious people and are of value. The answer is not to be destructive, but to provide leadership. This is what I've been doing for many years in ham radio . . . it is what I am trying to do now. Unfortunately I'm not a very good organizer or leader . . . and Oh, how I wish I were, for if we had one good leader now we would have nothing to fear from the future. A good leader would gather all amateurs behind him, put an end to ARRL hanky-panky, and guide amateur radio into the 70's stronger than it ever was before. Sorry.

Don't miss Caveat Emptor on page 92.

Dear Wayne,

K5JKX's articles are always read with great interest, because they contain a great deal of useful information, but the noise figure treatise in October's issue contains statements which I believe to be slightly misleading. In an example he states the case of two receivers whose specifications list equal sensitivities in microvolts, but one has a 3 db better N.F. He then states that the receiver with the 3 db advantage in N.F. will receive signals with a better signal-to-noise ratio. He is only partially correct; sensitivity is given and defined as the signal strength in microvolts (or any other common unit, such as dbm) required to produce a given s.n.r. at a given bandwidth. The N.F.'s quoted in his example, 3 db and 6 db, do nothing more than specify the relative noise bandwidths of the receivers (i.e., the 3 db receiver has twice the bandwidth of the 6 db receiver). However, and this is the point which has been overlooked, the 3 db receiver is *capable* of producing a better s.n.r. if the two receivers had equal bandwidths, or if the bandwidth were variable to suit the bandwidth requirements of the received signal and the desired reproduction fidelity. In most current amateur receivers, the bandwidth is fixed by a crystal filter, so if its sensitivity in microvolts is specified, this effectively defines its capability, and knowing the N.F. is not an increase in useful information.

In fact, the N.F. may easily be calculated knowing the bandwidth and sensitivity. First of all, let's assume an input impedance of 50 ohms so that microvolts may be converted to dbm (db below one microwatt). Also, let's say our receiver has a two kc bandwidth and requires a 0.1 microvolt signal to produce a 10 db s.n.r. Point one microvolts into 50 ohms is $(0.1 \times 10^{-6})^2/50 = 2 \times 10^{-16}$ watts, or 2×10^{-13} milliwatts. This in turn is —127 dbm. Noise equivalent power is commonly given as —11 dbm/mc. (This is another way of stating kTB at room temperature and 1 mc bandwidth. A bandwidth shape following a Gaussian distribution curve is of course implied, but the difference in effective noise bandwidth arising from our crystal filter shape factor is ignored for simplicity.) To complete the numbers required in our calculation, we must calculate the bandwidth in db for 2 kc relative to 1 mc. This is $2 \times 10^3/1 \times 10^6 = 2 \times 10^{-3}$ or —27 db. Noise figure may now be computed as follows:

$$\begin{aligned} \text{N.F.} &= 114 - \text{B.W.(db)} - \text{s.n.r.} + \text{sensitivity(dbm)} \\ &= 114 - (-27) - 10 + (-127) \\ &= 4 \text{ db} \end{aligned}$$

Noise figure is therefore a measure of a receiver's *capability*, but not of its *performance* under a given set of fixed conditions.

Ted Bergstrom, W1IQW
Ipswich, Massachusetts

Dear Wayne,

For a 73 "Stray" to counter the one by W2DTE, local bookstores here sell QST's and CQ's at two for a nickle, but no 73' since your readers in this area won't let them go. Honestly.

Bob Suerstedt WA6VAT
San Pablo, California

There is a good reason why the store on Sixth Avenue in New York doesn't have 73. Most of the magazines sold by used magazine stores are returns from the newsstands with part of their covers removed for refund by the magazine. Newsstand distributors tear a corner off the cover, return it to the publisher for credit and then selll the magazines for a penny or two to stores. 73 is not handled by a newsstand distributor so you won't find them in these stores.

Dear Wayne,

Keep up the good work Wayne. I love those editorials. Washington News makes amusing reading and since it is being sent to all IoAR members, how about suggesting that they use bigger type? Hi. Keep mentioning the names of advertisers who have dropped their ads because of your editorial policy. I certainly don't want to buy from someone where I'm not wanted.

Frank Nankin K4BNZ
IoAR Founding Member #301

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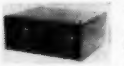

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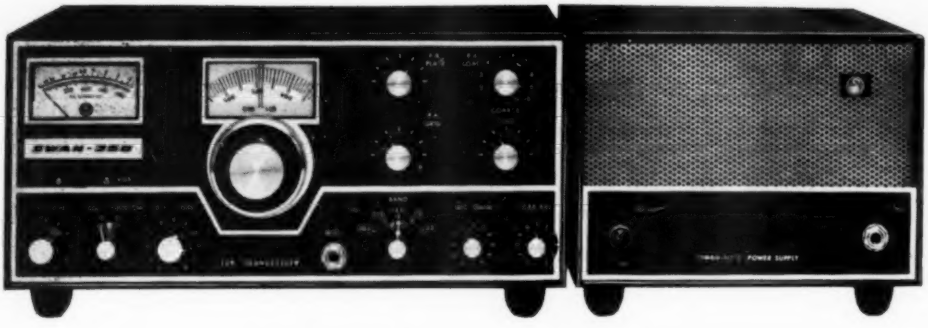
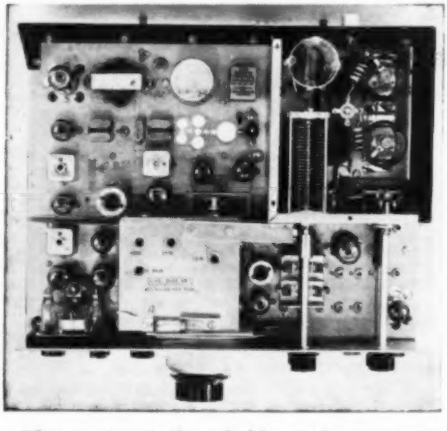


The Swan 350

Bill Siefkin WB6KEH

Excellent is the word for the new Swan 350 transceiver. The boys in Oceanside seem to have endless ability for producing top quality, economical, high performance single sideband transceivers.

Basically, the Swan 350 is a single sideband transceiver providing complete SSB or CW coverage of the 80-15 meter bands and one 500 kc portion of the 10 meter band. An optional modification kit is available for complete coverage of the 10 meter band. AM operation is accomplished by zero-beating the received signal and inserting a carrier into the transmitted sideband emission.



The receiver is the reliable single conversion design that is found in the Swan 100 and 240 series. The dual ratio tuning has that expensive feel to it, which is characteristic of the engineering excellence built into this rig. The transistorized VFO is temperature and voltage stabilized. Push-to-talk operation is provided, and an optional VOX accessory is available.

It weighs only 17¾ lbs and measures but 5½ × 13 × 11 in. It is ideal for convenient fixed, portable, or mobile installations. The unit runs over 400 watts PEP on SSB, 320 watts dc input on CW, and 125 watts dc on AM. The transceiver provides automatic gain control (AGC), automatic level control (ALC), and grid-block CW keying. Recommended power supplies are the Model 117C for ac operation, and Model 412 for 12-volt dc operation.

The transceiver uses 15 tubes, voltage regulator, two transistors, and five diodes. A 6GK6 drives two AB_1 6HF5s. Unwanted sideband suppression is down 40 db, carrier suppression is at least 50 db, and third order distortion is down 30 db. A lighted combination power amplifier cathode current and "S" meter is provided.

During the first weekend of operation, I worked 12 states, an XE2, KL7, and KH6. Sideband and carrier suppression, distortion, audio quality, and signal width reports were highly satisfactory. I don't miss VOX. I'd just as soon have a rig that is not "fully automatic." 599 reports on CW were common across the country.

The new Swan 350 represents an outstanding value in amateur communications. The prices are only $395 for the transceiver, $85 for the ac supply, and $130 for the transistorized dc supply. The circuit is completely hand wired, except for a portion of the VFO.

Considering performance, reliability, craftsmanship, and price, I believe one could not go wrong in investing in this excellent piece of amateur communications equipment.

. . . WB6KEH

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- ☐ 6 TEXAS ONE AMP. 400 VOLT epoxy rectifiers .. $1
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- ☐ 10 FAMOUS CK722 TRANSISTORS, pnp $1
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- ☐ 3 2N1264 UHF TRANSISTORS, 300 mc TO5 case .. $1
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- ☐ 25 SEMI-KON-DUCTORS, transistors, diodes, rect. . $1
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- ☐ 5 SUN BATTERIES TO 1 1/2" sizes, lite sensitive . $1
- ☐ 1 3N35 TETRODE, 150mc transistor, silicon $1
- ☐ 30 TRANSISTORS, pnp-n-npn, TO5 cases........ $1
- ☐ 4—2N522A TRANSISTORS, by Industrial, TO5... $1
- ☐ 10 PRINTED CIRCUIT Transistors, 2N212, npn's too $1
- ☐ 10 2-AMP RECTIFIERS, 50 to 400V, studs...... $1
- ☐ 3—40W. TRANSISTORS. by Motorola, like 2N178. $1
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10 WATT STUD ZENERS 1.00 EA.

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☐ 8V
☐ 12V
☐ 20V
☐ 24V
☐ 42V
☐ 45V
☐ 60V
☐ 70V
☐ 80V
☐ 90V
☐ 110V
☐ 100V
☐ 124V
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Crystal freqs: 40 to 60mc. Use as freq. standard, marker, osc, etc. Wired, printed circuit. ONLY 2 x 2 x ¼" With crystal thermistor 1200MC transistor.

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Like	W.	VCB*	HFE	FREQmc
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☐ 2N708	.36	20	30	480
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☐ 2N995**	.36	15	140*	100
☐ 2N996**	.36	12	100*	120
☐ 2N1613	.8	50	120*	80
☐ 2N1893	.8	100	120*	70
☐ 2N2049	.8	50	300*	85
☐ 2N2645	.5	50	300*	85
☐ 2N2695**	.36	25	130*	100

*Maximums **PNP's

ONLY **$1.00 EACH**

Lafayette HE-45B

A. A. Wicks K3VHK/6
23045 Altamead Drive
Mountain View, California

Although not a recent market item, the Lafayette HE-45B has received little publicity since being modified from the HE-45. Nevertheless, this compact unit is a real sleeper. It deserves the attention of the six-meter enthusiast for fixed or mobile use or both.

The transceiver as received from Lafayette is complete. You can be on the air within five minutes of unpacking if you have an antenna up! A good ceramic push-to-talk microphone with AC and DC cables and plugs (already wired), a crystal for 50.124 mc, and a detachable mounting bracket are included. The latter may be left on when used as a fixed station, permitting the unit to face the operator with the slope of the panel adjustable. For mobile operation, the bracket provides the main support for underdash mounting. An additional rear strap support (which may not be needed) is also supplied.

The unit is attractive. It even met the approval of my XYL. It measures but 12 inches wide by 5 inches high, so the unit requires very little space in a standard size car and would even fit well in a compact.

Operating controls are functional. They provide all of the necessities without complicating mobile operation. However, tune-up for maximum output cannot be accomplished easily while in motion. Once the transmitter is peaked for maximum output on one frequency, the only controls that need touching are the receiver dial and volume control. An rf peaking control in the secondary of the 50.2 mc rf bandpass transformer is quite sharp, but once peaked does not need retuning over about a 2 mc range. The series-gate noise limiter is very effective, and is best left in full operation when mobile (if not for your own car, then for others). Noise is completely eliminated by the limiter in my 1960 Chevrolet, which has just the usual auto radio noise-suppression capacitors (generator, etc.), and no spark plug suppression. The noise control also functions as a convenient push-on, push-off standby switch. Two crystal sockets and a VFO socket are provided. Front panel switching of these three positions is provided. Power for a VFO may be obtained from a receptacle on the rear apron. It is designed for the Lafayette HE-61A 6-meter VFO, but many other VFO's can be used. A spotting switch completes the crystal oscillator (or VFO) circuit in the receive position. One other switch al-

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instead of later.

This General Radio heterodyne frequency meter and crystal controlled calibrator is one of the best surplus bargains you will ever see. It comes to you all ready to plug in and use. Absolutely no conversion whatever is necessary. It is ideal for the ham shack . . . or for any commercial lab. The range is from 160 kc to 30 mc with direct calibration and up to 120 mc with harmonics. This is a secondary frequency standard and frequencies can be read to within a few cycles on the meter. Voltage regulated to extremes; temperatur controlled.

It weighs 155 pounds, but this is because it is built to last without trouble for years. These units sold for over $3000 for several years and have recently been advertised for as low as $900. We have a limited number of these fabulous freq meters for only $75 fob Pasadena. It is unlikely that you'll ever see these available again so buy now while we still have a few left. Ask any Navy op about the LR, or ask W2NSD or W6ITH, both of whom have used them for years.

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MUrray 1-7393

General
Radio
LR-1

lows the meter on the transceiver to function either as an S-meter or relative power output meter. The S-meter is conservative.

Tuning-up is relatively simple. The usual pi-network output circuit permits just about any piece of wire to load. Tuning to resonance (maximum reading on panel milliameter marked Prf) is done with a front panel knob marked TANK. Loading is then performed by working on a screwdriver slot capacitor through a hole in the front panel. It is convenient to put a small knob on the loading control because this tuning is sufficiently sharp that retuning is necessary even when changing frequency a few kilocycles.

The same power input receptacle is used for both mobile and fixed operation, but the fused mobile power cable is terminated on one end with a cigaret lighter plug. This plug was removed in our installation, and a permanent connection made to an underdash spare fuse block.

The receiver is very adequate, with a sensitivity of 1 microvolt, and selectivity 3 kc at 6 db down. Image rejection is 45 db. Three *if* stages are incorporated, and a tuned rf bandpass stage ahead of the detector provides additional selectivity.

The transmitter portion of the unit is entirely separate in circuitry from the receiver except for the modulator. Half of a 6AW8 is used as an oscillator (buffer on VFO), with the crystal/vfo frequency-tripling in a second half. The 2E26 output tube operating Class C runs at 15 watts input. The modulator uses a 6EA8 as a speech amplifier with a 7868 doubling as a screen modulator for the 2E26 and as receiver audio output.

The power supply uses silicon rectifiers. For mobile operation, a 12-volt vibrator is used.

Performance was excellent over a three-month period operating from Pennsylvania to California. When 6-meter activity was found, contacts were made without difficulty with excellent reports both as to quantity and excellent quality of the signal. Contacts have been made consistently up to 15 miles mobile. and in some areas contacts were made in motion at distances of up to 60 miles with S7 to S9+ reports normal. In all of the mobile contacts the antenna used has been a front-cowl mounted New-Tronics NB-40 vertical antenna. In fixed operation during a recent band opening with a ground plane antenna 20 feet up, a good contact was made California-to-Colorado.

The HB-45B at $119.95 f.o.b. Syosset represents an excellent buy.

. . . K3JHK/6

ALL-BAND RECEIVER BARGAIN: Continuous tuning 550 kc to 48 mc Voice, CW, MCW. R-45/ARR-7 has 2 stages RF, 2 stages 455 kc IF, separate Local Osc. w/VR AF, S-Meter, Noise-Limiter, Crystal & non-crystal IF Pass in 6 pass selections. Less pwr sply but w/pwr sply dwg, complete Handbook, and much other data. Checked 100% perfect, fob Los Angeles, only **149.50**
Add $30 for 115/230 v 50/60 cy pwr sply. Add $20 for modification by us to SSB by addition of Product Detector.

TIME PAY PLAN: Any purchase totaling $160.00 or more, down payment only **10%**

ARC-5 Q-5'er Rcvr 190-550 kc w/85 kc IF's. Use as 2nd converter for above or other rcvrs. Checked electrically, w/lots of tech. data, w/spline knob. 9 lbs fob Los Ang. **14.95**
(Add $3 for extra-clean selected unit.)

NAVY'S PRIDE, RBS RECEIVER 2-20 mc 14-tube superhet, checked & ready to use, w/pwr sply, tech data, fob Charleston, S. C. **69.50**

AN/APR-4 RECEIVING SET: Tune 38 to 1000 mc. Includes TN-16, 17, 18/APR 4: plug: handbook; checked, grtd OK, fob Los Angeles **179.50**
Add $60 for TN-19, 975-2200 mc; add $125 for TN-54, 2175-4000 mc; add $80 for AM/FM version of the rcvr, w/60 cy pwr sply; add $90 for 60 cy Panadapter 30 mc ± 1½ mc IP-111; add $125 for RDP Panadapter w/5" CR, 30 mc ± 5 mc.

FM RCVR/XMTR 30-40 mc, 50 W Po. 120v, 60 cy. AN/FRC-6A; in rack cabinet w/meters, spkr, etc. Xlnt **79.50**

LM FREQ. METER 125 kc to 20 mc is combin. heter. freq. meter & signal source, CW or AM, accuracy .01%, xtl calib. Clean, checked, 100% grtd. w/plug, data. 16 lbs fob LA **57.50**
Add $22 for LM sply w/plugs, data, or $10 for EAO, converts for LM w/parts, data, included.

TS-323/UR, 20-400 mc, similar GERTSCH FM-1. Crystal. 001%. W/handbook supplement giving supplementary xtl check points & instruct. to ". . . closely approach crystal accuracy." W/schematic, instruct., pwr sply data, clean, checked, 100% grtd. fob Los Ang. **199.50**

BERKELEY COUNTER #5571 is basic 0-2 mc freq. meter plus extender to 42 mc 100% OK grtd. w/book. fob Los Angeles, only **795.00**

PWR SPLY FOR ART-13 & OTHER XMTRS. 115v 50/60 cy in both HV's out. New **79.50**

TEST SCOPE TS-34/AP 40 cy—3 mc ± 3 db. Lens simulates 5" screen. Ready to use **39.50**

TEKTRONIX SCOPES grtd OK & gorgeous, w/books: #514A: DC to 10 mc; sensit. 30 mv/cm; sweep calib. uv/cm: calib. deflection **395.00**
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LP SIGNAL GENERATOR 9½ mc to 50 mc 1%, calib. Vo to 1.0 v. Complete, certified **199.50**

TS-418A/U SIGNAL GEN. .075-40 mc 1%, xtl calib., Vo calib. to 1.0 v. Certif. **279.50**

GEN. RADIO #805-C MICROVOLTER 16 kc to 50 mc, 2 v into 37½ ohms. Like new, 100% grtd. w/book. Regular $2250, only **750.00**

MEAS. CORP. #80 SIGNAL GEN. 2-400 mc, ½%. Vo calib. to 100,000 uv. Certified **375.00**

NAVY LAE-2 MICROVOLTER 520-1300 mc, new, w/all charts, cords, book **129.50**

C-BAND MICROVOLTER AN/URM-35, 4.45-8 kmc, —100 to 0 dbm, w/all pulse mod. capabilities. Internal 400 cy pwr sply **295.00**

BOONTON #202-F MICROVOLTER 175-225 mc, up to 0.2 v CW/AM/FM, new, with book **275.00**

BOONTON #152A CITIZEN'S BAND MICROVOLTER 1-5 mc for IF, 20-28 mc for RF. AM & FM, w/6 mod. freq. Up to 100,000 uv. Terminated cord, pwr sply, book, grtd **225.00**

X-BAND MICROVOLTER TS-739B/UPM-10, 8.5-9.6 kmc CW/FM/PM, —83 to +30 dbm **395.00**

WESTON INDUSTRIAL-TYPE TUBE ANALYZER Mod. 686 Type 9B has 6 meters, 42 controls. W/book, exc. cond., regular $1100, only **179.50**

NEW LOW PRICE on ungraded SILICON DIODES, various PIV's & Currents, some good, some bad, you grade them with Instruction included. 100 for only **2.95**

PLENTY MORE WONDERFUL MATERIAL! Ask for your needs! We ALSO BUY your excess mdse.

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REMOTE CONTROL AMPLIFIER

Brand new. Type CAY-23304A, Power req'd 117 VAC-DC 37 Watts.
Audio power output 1.3 Watts 600 Ohms 250-350 cycles + 2 DVB.
Excellent for use at intercom master station or small paging system.
Contains telephone type mike & earphone.

New, with spare parts	$12.95
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BRAND NEW—made for banks for encoding savings accounts passbooks. A GADGETEERS DELIGHT.
Partial list of parts:
Dual High Voltage Power Supply using H. V. SELENIUM rectifiers approx. 2000 V.D.C., timing motors, rack and pinion drive system, 2 projection lamps and sockets, objective eye piece lens, fibre optics, cam timer, pilot lights, relays etc.
All this in a betutiful NEW sloping aluminum cabinet.
Shpt. wt. 50# Price: $14.95

FIELD TELEPHONE SETS

Type EE8. Complete in carrying case. Shpg. Wt., 18 lbs.
Cat. No. S-6443 $9.95, 2 for $18.00

420 MC TRANSCEIVERS

The same as one we sold for $34.95 except the vibrators, 5894A, cables and mike are missing. Most of the small tubes are included. These units are excellent for stripping and using the tripler-amplifier chassis to get on 420 mc with about 2-3 watts drive on 2 meters. Type 829B tubes may be substituted for the 5894 at reduced output. Cat. #S-7129. Price $9.95

5894A TUBES

Price $7.95 ea. or 2/$15.00

MOBILE MIKE

Shure Dynamic high impedance push to talk with 5' coiled cord & 4 pin Amphenol Mike Connector. Price: $2.95
P.M. Speaker in 5½" Round Metal Case 6—8 Ohms.
V.C. MIKE & SPEAKER combination. Price: $3.50

MODEL WR-36A

Produces black and white dots, color rainbow pattern, and a 3.58 mc subcarrier for alignment and adjustment of color receivers. Has RF output for insertion of signal into receiver antenna terminals and video output.
In excellent condition. Shpg. Wt., 30 lbs.
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FILAMENT TRANSFORMERS

Pri: 115 or 230 v. 60 cy. Sec: 6.3 v.c.t. at 6.5a. Cat. #S-7119. Price $1.00

All prices are F.O.B. our warehouse Philadelphia, Pa.
All merchandise accurate as to description to the best of our knowledge.

Your purchase money refunded if not satisfied.

TERMS: Our terms are cash. All trade and cash discounts have already been deduced in our catalog quotations.

Minimum order — $3.00

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DO IT YOURSELF KIT

K.W. Silicon Rectifier assembly kit—consisting of diodes and resistor capacitor network. Full assembly instructions included. Can be used in either full wave center tap or full wave bridge configuration—up to 3500 volts at 1 amp. $19.95
Higher power kits or custom built units available on request.

BRUTE POWER SOLID STATE SUPPLY KIT

Husky mil. spec. transformer—choke combination to supply HI & LOW Voltage at plenty of current for any of the modern 150-300 Watt P.E.P. Transceivers or Exciters.
At full rated current (300 mils or better) regulation better than 10%. Full instuctions and schematic included.
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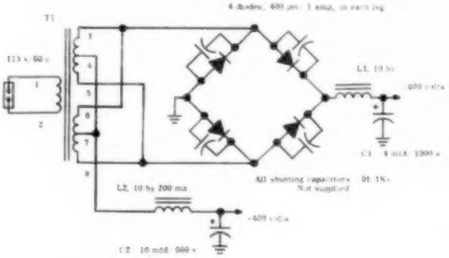

METERS

0-1-	MA D.C.	2½"	Rd. Rugg.	@ $2.95
0-5-	R. F. amps	2½"	Rd.	@ 2.95
0-2-	R. F. amps (Thermo couple)	2½"	Rd.	@ 2.00
0-15-	V.A.C.	2½"	Rd.	@ 1.49
0-50	MA.	2½"	Rd. Rugg.	@ 2.95

APR—1 TUNING UNIT

30 to 90 mc. TN-1B
Easy converted to 6 meters.
BRAND NEW. Shpt. wt. 26#
S-7131 $19.95

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Pri: 115V 60 cy. 1ϕ.
Sec. 1800-0-1800V RMS @ 300 Ma DC C.C.S. (in full wave choke input system).

BRAND NEW open frame mtg.
Shpt. wt. 20#
S-6550 $27.95

RG 8/U COAX CABLE

17' L. with type N connectors each end. UG 21 C U. NEW.
PRICE: $2.00

COAX CONNECTORS

SO-239	Price: 6/$1.00
PL-258	35c ea. 3/$1.00

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Philadelphia, Pa.
HO 8-7891 — HO 8-4645

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100TH	Price: $8.00 or 2/$15.00
807	Price: .75
5R4 WGY	Price: 1.00
6AS7G	Price. 1.25
6AK5	Price: .50
6AH6	Price: .60

POWER TRANSFORMERS

1000 V.C.T. @ 275 ma. 105-125 Volts input 60 cy. 1 each 6.3 V @ 10 amps. 2 each 5 V @ 4 amps.
Price: $4.95 S-7140
Shpt. wt. 11#

TUBE REPLACEMENTS

DIRECT PLUG IN REPLACEMENT. NO RE-WIRING NECESSARY. At least 60 V more B+ and current capabilities up to 1 amp. D.C. for item #SA.

Replace the following tube types #5Y3, 5U4, 5Y3G, 5Y3GT, 5V4, 5V4GT, 5AU4, 5T4, 5W4, 5Z4, 5AW4, 5V3, 5AS4, 5AX4, 5AZ4.
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5R4	Price: $3.95	#SC
OZ4—6X5 REPLACEMENT	Price: $1.95	#SE
5X4—5Y4 REPLACEMENT	Price: $1.95	#SF

POWER TESTED SILICON RECTIFIER UNITS

(1 amp. @ 1 ma. max. leakage)

50—200 PIV	price 6c ea.
200—400 PIV	price 14c ea.
400—600 PIV	price 24c ea.
600—800 PIV	price 36c ea.
800 or better	price 44c ea.
1000 PIV	price 54c ea.

POWER TESTED SILICON RECTIFIER UNITS

(All 5 amps)

200—400 V	price 39c ea.
400—600 V	price 49c ea.
700 V	price 69c ea.
800 V	price 84c ea.
1000 V	price $1.99 ea.

All prices are F.O.B. our warehouse Philadelphia, Pa.

All merchandise accurate as to description to the best of our knowledge.

Your purchase money refunded if not satisfied.

TERMS: Our terns are cash. All trade and cash discounts have already been deducted in our catalog quotations.

Minimum order — $3.00

POWER TESTED SILICON RECTIFIER UNITS

(All 35 amps)

50 V	price .84 ea.
100 V	price .92 ea.
200 V	price 1.94 ea.
300 V	price 2.68 ea.
400 V	price 2.99 ea.
500 V	price 3.28 ea.
600 V	price 4.08 ea.

TUBULAR HIGH CAP. ELECTROLYTICS

cap.	w.v.d.c.	price	2 for	Cat. #
20,000	MFD 25v.	$ .95	$1.50	S-7120
25,000	MFD 25v.	1.25	2.00	7121
20,000	MFD 30v.	1.25	2.00	7122
40,000	MFD 10v.	.95	1.50	7123
40,000	MFD 30v.	1.75	3.00	7124
8,000	MFD 55v.	.95	1.50	7125

RDZ POWER SUPPLY

D.C. power supply mfg. for MARS or RDZ receiver, Input 115 v.a.c. 50/60 cy. Output 30 v.d.c. @ 200 ma well filtered thru two 8 hy 200 ma chokes and two 10 mf. capacitors thru a VR-150. 6.3 v.c.t. @ 10 amps and 12 v.a.c. @ 3 amps. Meas. 5½" x 9" x 17". Complete with tubes. Shpt. wt. 65#.
PRICE ONLY: $14.95 S-6262

SUPER PRO POWER SUPPLY

Rack Mounted Excellent condition.
Shpt. wt. 60# Price: $19.95 S-6609

TRANSFORMERS

Pri. 115 V 1 ph. 60 cy.
Sec. #1 6.3V C. T. @ 20 amps.
Sec. #2 8V @ 1 amp.
PRICE: $3.50 ea.

Pri. 115 V 1 ph. 60 cy.
Sec. #1 6:3V. C. T. @ 0.6 amps.
Sec. #2 6.3V. @ 2.25 amps.
Sec. #3 6.3V. C. T. @ 2.4 amps.
Sec. #4 6.3V. @ 22 amps.
PRICE: $4.50 ea.

AERIAL WIRE

Reel contains approximately 138 feet of phosphor bronze, no. 16 stranded, 200 lb. ttst antenna wire. Has galvanized clips on ends. Brand new.

Shpg. Wt., 3 lbs.

Cat. No. S-6313 $1.50, 4 for $5.00

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Reciprocation?

No, not yet. The RSGB did manage a good coup when they got permission from the Post Office to permit foreign amateurs to operate the amateur stations at their recent RSGB exhibition in London. Shown here are Jeff Stone G3FZL, the President of RSGB, John Boyce G4NI, Chet Lambert W4WDR, the first foreign operator of GB3RS (first contact was with DJ8SW), and logging this memorable event is the Exhibition Secretary Ron Vaughn G3FRV.

(de W2NSD/1 from page 4)

lared for me to come see. It was an awful sight. The 48 element beam was lying in a mangled heap about thirty feet from the tower. The two inch seamless hardened steel mast which we had sent all the way to New York for had sheared off right at the top of the tower. That ice storm had been too much for it. We looked over at the next tower and the 432 mc 96 element beam was now in moonbounce position, having bent over to a 90° angle. Drat.

Reminds me of Sam Harris' postulate . . . if your antennas stay up more than a year they weren't big enough.

LMRE vs ARRL

There seems to be some skull-duggery going on here too. Apparently the top staff at HQ is still brooding over the IARU fiasco for I have reports that they seem to be working with ARAM, an anti-LMRE (Mexican Amateur Radio League) group.

Infamous?

The other day a letter came in that caught my eye. It was addressed to Wayne Green, 73 Ville, N. H. It got here promptly too. I don't know how they did it, but they did.

London May 29th

There will be an SSB Dinner in London on May 29th for those of you who are reasonably portable. It will be held at the Waldorf Hotel, Aldwych, London WC2. Food, entertainment, equipment displays and prizes are promised. Write to Norman Fitch G3FPK, 79 Murchison Road, London E10. Apparently several W's are planning on being there . . . how about you?

Outstanding W1 Award

Nominations are in order for the outstanding New England ham who has performed a meritorious public service to his community through the medium of amateur radio or made a major contribution to the science of amateur radio or helped greatly to stimulate interest in amateur radio in others or aided other radio amateurs to acquire a greater knowledge and skill in operating or building amateur radio equipment. Send complete and accurate nominations to Eli Nannis W1HKG, 37 Lowell Street, Malden, Mass. before March 26th. The award will be presented at the Swampscott Convention, April 24-25.

. . . Wayne

TS 418A 400-1000 meg signal generators, AM, PM or CW emission	**$325.00**
Baird Atomic 162 Glow transfer counters	**$100.00**
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Ballantine 300 Voltmeter	**$70.00**
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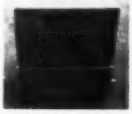

Potter model 471 chronograph counter to 8 Megacycles with manual **$400.00**

8100 MFD at 20 volts electrolytic condensers, new **$.75 ea., 10 for $6.00**

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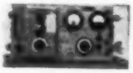
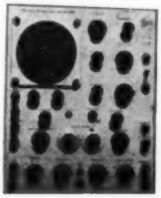


TS-497B 2-400 Meg Signal Generator with manual **$225.00**



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STEP-DOWN POWER XFMR—Input 117vAC, 60cy. Output 24vCT @ 10 Amps. Double shell, wire leads. New **$6.95**

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Dick Dundon W7LIA/WA4VVE

Putting the SB-33 on AM

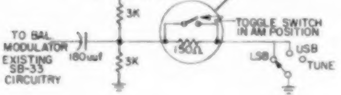
Putting a SSB transmitter on AM usually involves unbalancing the carrier in the low level stages. The SB-33 transceiver can be put on AM very easily and economically by unbalancing the carrier in a manner similar to that used when the transceiver is in the "tune" position. The only parts needed are a 150 ohm ½watt resistor and a sub-miniature spst toggle switch.

Modification

The modification can be done as follows:

Take the case from the chassis by removing the (4) screws on the bottom and sliding the case off the chassis while the chassis is held with the panel side up.

Layout the toggle switch location to suit the particular sized switch you intend to install. It is recommended that a sub-miniature spdt micro-switch be used, because of its small size; however, a standard size toggle switch can be fitted in place with careful attention to locating the switch between the plastic frequency dial plate and the left hand side (as viewed from the front) of the exciter tuning condenser.



Drill the hole for the toggle switch with extreme care. Do not drill through the front panel more than ¼ inch because you will damage components on the chassis.

On the bench, make a sub assembly of the toggle switch, the 150 ohm resistor and a two inch piece of hook-up wire. When properly assembled, the toggle switch shorts out the resistor.

On the SB-33 function switch (LSB, USB, TUNE) locate the white *unshielded* wire. This wire comes from the under-chassis junction of (2) 3000 ohm resistors and (1) 180 mmfd condensor.

Transfer this wire from the function switch to the toggle switch and solder.

Install the toggle switch by feeding the two inch piece of hook-up wire up through the function switch to the switch terminal formerly occupied by the white unshielded lead named above.

Solder the two inch lead from the toggle switch to the function switch. Check all solder joints and see that all wires are in the clear.

Checkout

Before re-assembling the case and the chassis perform the following checks. A dummy load or resonant antenna is required. It is recommended that a receiver with an "S" meter be available, also.

Tune up the SB-33 on 75 meters according to the manufacturer's instructions. Note: The "AM" switch is not in the circuit when the SB-33 is in the "Tune" position. Switch the SB-33 to either LSB or USB. With the "AM" switch in the AM position, the plate meter should read 150 ma to 160 ma. (This is 1.5 to 1.6 on the current scale.) With the AM switch in the SSB position, the current should drop to approximately 80 ma or 90 ma. (This is .8 to .9 on the current scale.)

With the SB-33 in SSB position, recheck the carrier balance per manufacturer's instructions. A quick carrier balance check can be made by listening for carrier with a communication receiver. The SB-33 should be in SSB position with the mike gain turned off. Rebalancing may be required. After checkout of the added AM switch, it is recommended that suitable decals be added to the front panel to note AM and SSB.

Operation

If operating in the SSB position, it is only necessary to switch the AM switch to AM and reduce the audio gain approximately half. It is extremely important that when in the AM position, you *reduce* the audio gain approximately half so that the meter only occasionally flicks on modulation peaks. Remember, in the AM position too much audio will cause extreme distortion and practically eliminate all intelligibility.

According to the manufacturer's specifications the SB-33 delivers 150 watts PEP input and approximately 70 watts output. In the AM position you are expending approximately 100 watts input and will realize approximately 25 to 30 watts output (or that of an AF67 or G77A). . . . W7LIA/WA4VVE

50 AMP DIODE SALE

50 VOLT	$2.00
100 VOLT	2.50
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Copper one side.
Approx 4 x 10 **8/$1.00**

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RG 8A/U	100 ft.	**$9.00**
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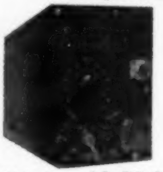

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IP-274/ALA-10 2 meter pan-adapter. 30 MC input, 10 MC band width; 400 cycle power supply. Complete with 3BP-1 CRT, all tubes, schecatic instructions for conversion to solid state 60 cycle power supply; and to 18 MC input, if desired. Or see June 1964 issue of 73. Very excellent used. $30.00

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- ★ Price—$2 per 25 words for non-commercial ads; $5 per 25 words for business ventures. No display ads or agency discount. Include your check with order.
- ★ Type copy on standard size paper. Phrase and punctuate exactly as you wish it to appear. No all-capital ads. Include your signature with order.
- ★ We can only accept ads related to ham radio. We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.
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Sonar SRT-120P Transmitter, 10-80M, 120 watts, 100 watts phone, push-to-talk, built in power supply, 5984 final, VFO-Xtal, excellent condition, cost $300, will sell for $125 complete. Box 151, 73 Magazine, Peterborough, N. H.

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HAM TV Deflection & Focus Coil Kit is now available with complete Instruction Manual of a 5 tube Vidicon Camera for only $19.90. Kit has 1 set of pre-formed vertical and horizontal coils with shielded coil form — pre-wound focus coil with target connector and inner shield and mu metal outer shield. ATV Research, P. O. Box 396, South Sioux City, Nebraska, 68776.

The third annual mid-winter Ham Swap and Shop will be held at the DuPage County Fairgrounds at Wheaton, Illinois on Sunday, Feb. 21. All amateurs, CB'ers, and hobbyists are invited to attend and to bring any equipment that they wish to swap or sell. $1.00 donation is payable at the door. For further information contact John Koranek, K9GTT, 505 East Ellinois Street, Wheaton, Illinois.

WANTED . . . Telephones . . . Crank, Dial or Touch-Tone, and associated equipment. Send post-card stating make, type, condition, and cost or trade wanted. K9LGJ, P. O. Box 11, Milton, Ind. 47357.

Elmac, AF-67 and PMR-7, xmitter converted to six meters, 160 meters removed, all Elmac power supplies included. Make offer. Anthony W. Cline, K1PNI, 133 Larchmont Road, Warwick, Rhode Island 02886.

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DUMMY LOAD, 50 ohms. All bands up to legal limit. Size, 3 x 4 x 7. Coax connector. Kit $7.75, wired $9.75 pp. Ham Kits. Bx 175, Cranford, N. J.

IARC

The International Amateur Radio Club at Geneva has announced a convention to be held September 17-19, 1965. Also, contributions are now solicited for the 1965 edition of "4U1ITU Calling" which will be published for the ITU Centenary, May 16-17. Send all material to IARC, Geneva 2, Switzerland. A special QSL will be available to all amateurs who contact 4U1ITU during this celebration. If you would like to operate 4U1ITU please write immediately.

Signal Corps Technical Manuals, Instruction books and other material pertaining to signal corp equipment and etc. Manuals are New or like new. All are shipped postpaid USA. If faster means desired, add additional money to cover cost. All shipped parcel post otherwise. Due to size and weight of some manuals, a higher price is asked.

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NAVY TECHNICAL MANUAL—Teletypewriters TT-47C/UG, TT-48B/UG, TT-69B/UG, TT-70C/UG, TT-128A/UG, TT-129A, TT-130A, TT-131A/UG, TT-171/UG, TT-234/SGA-3	$3.00
TM 11-957 Rectifier RA-87 (Teletype pwr supply)	$1.00
TM 11-264A Radio Set AN/GRC-26A (BC-610 schematic, H&I R-388/URR schematic, Freq. Shift Exciter Schematic	$1.50
TM 11-692C Radio Set AN/ARC-27	$2.25
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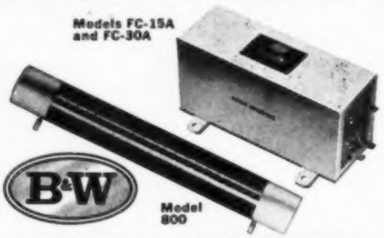

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200	2.20	2.80	600	5.45	5.85

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0A3	.80	6C4	.45	45	Q
0B2	.65	6C5	.69	50L6	.69
0C3	.70	6C6	1.08	RK59	1.39
0D3	.50	6C8	1.08	RK60	1.17
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1A7	.90	6CB6	.89	75	.81
1B3	.99	6CD6	1.49	HY75	5.00
1L4	.82	6CF6	.85	83V	.95
1R4	5/$1	6CL6	1.40		

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1S4	.78	6CG8	1.12	4-124A	27.50
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1T4	.85	6CS6	.70	4X250B	41.00
1T5	.95	6CU6	1.29	4-400A	41.75
1U4	6/$1	6D6	.99	4E27A	39.00
1U5	.75	6E5	.79	250TL	19.45
1X2	.99	6F4	2.49	307A	2/$1
2C39A	Q	6F5	.63	316A	Q
2C40	5.50	6F6	.99	VR92	5/$1

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2C51	2.00	6F8	1.39	350A	2.45
2D21	.65	6H6	.59	350B	1.75
2E22	Q	6J4	1.72	371B	.95
2E24	Q	6J5	.59	6146	3.90
2E25	2.50	6J6	.59	416B	16.00
2E26	Q	6J7	.99	450TH	43.00
2E30	Q	6J8	1.39	450TL	43.00
2E35	1.60	6K6	.59	460	11.50
2K25	9.75	6K7	.79		

All Tubes Stocked at Low Prices!

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2K28	30.00	6L6	1.19	707B	3.50
2V3	2/$1	6SN7	.72	715C	10.90
2X2	.48	6T8	.98	717A	5/$1
3A4	.70	6V6GT	.90	723AB	5.00
3A5	1.00	6X5	.49	725A	2.75
3AP1	Q	12AT6	.59	803	3.50
3BP1	Q	12AT7	.89	804	8.85
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3E29	6.00	12AX7	.79		
3Q4	.68	12AY7	1.29		
3Q5	.86	12B4	.95		
4-65A	13.50	12BA6	.65		
4-125A	27.50	12BA7	.99	811	Q
4-250A	34.00	12BD6	.59	811A	Q
4X150A	Q	12BE6	.59	812	Q
4X250	36.00	12BH6	.79	813	9.95
4X500	Q	12BH7	.99	815	1.75
5AP1	2.95	12BY7	1.00	826	Q

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5BP4	7.95	12H6	.75	829B	8.00
5CP1	Q	12J5	.69	832A	6.00
5CP7	9.00	12J7	.69	833A	36.00
5R4	1.00	12J8	1.35	837	Q
5T4	.90	12K8	.89	866A	2.25
5U4	.99	12SA7	.69	954	Q
5V4	.89	12SC7	.89	955	3/$1
5Y3	.60	12SF5	.69	957	3/$1
5Z3	.89	12SG7	.89	958A	2/$1

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6A7	1.00	12SJ7	.75	1614	2.75
6A8	.99	12SK7	.75	1619	5/$1
6AB4	.59	12SL7	.79	1620	2.00
6AC7	.72	12SN7	.69	1626	3/$1
6AG5	.65	12SQ7	.69	1628	5/$1
6AG7	.75	12SR7	.69	1629	4/$1
6AK5	.69	15E	1.19	1050	1.25
6AL5	.55	15R	4/$1	5517	1.25
6AQ5	.66	FG17	Q	5608	3.95

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6AT6	2/$1	25A6	1.19	5654	1.20
6AU6	.79	25A7	2.19	5656	4.25
6B8	1.35	25C5	.81	5663	1.15
6BA6	.59	25L6	.72	5670	.90
6BE6	.59	25T	4.00	5686	1.75
6BG6	1.49	25Z5	.72	5687	1.15
6BH6	.79	25Z6	.75	5691	4.70
6BJ6	.72	26A7	3.69	5725	1.95

Top $$$ Paid for XMTTR Tubes!

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6BL7	1.35	HV27	19.39	5736	85.00
6BN4	.69	28D7	.89	5749	1.95
6BN6	1.08	FG33	15.00	5750	2.75
6BN7	1.99	EL34	3.49	5751	1.25
6BQ6	1.19	35A5	.69	5814	1.20
6BQ7	.99	35L6	.59	5879	1.20
6BX7	1.11	35T	4.49	5894	12.00
6BY5	1.19	35Z5	1.25	No See—	
6BZ6	.91	RK39	2.99	Write!	

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DC AMP	50Piv 35Rms	100Piv 70Rms	150Piv 105Rms	200Piv 140Rms
3	.08	.14	.17	.24
12	.30	.55	.70	.85
18*	.20	30	.50	.75
35	.70	1.00	1.50	2.00
100	1.65	2.05	2.50	3.15
240	3.75	4.75	5.75	8.75

DC AMP	300Piv 210Rms	400Piv 280Rms	500Piv 350Rms	600Piv 420Rms
3	.29	.30	.40	.48
12	1.00	1.35	1.45	1.70
18*	1.00	1.50	Query	Query
35	2.15	2.45	2.75	3.33
100	3.75	4.60	5.50	8.00
240	11.70	17.10	23.94	29.70

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February 1965

EASTERN UNITED STATES TO:

GMT -	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	7	7	7*	14	14	14
ARGENTINA	14	7#	7#	7	7	7	14	14	14*	21	21*	14
AUSTRALIA	14	7#	7#	7#	7#	7#	7	14	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	14
ENGLAND	7	7	3	3	3	3*	14	14	14	14	14	7#
HAWAII	14	7#	7	7	7	7	7	7#	14	14	14*	14*
INDIA	7	7	3#	3#	3#	3#	14	14	14	7#	7#	7
JAPAN	14	7#	7#	7#	3*	3*	7	7	7#	7#	7#	14
MEXICO	14	7	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	7#	7#	7#	3#	3#	7	7	7	7#	7#	7*
PUERTO RICO	7	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7#	7#	7#	14	14	21	14*	14*	14
U. S. S. R.	7	3	3	3	3#	3#	14	14	14	7#	7#	7
WEST COAST	14	7	7	7	7	7	7	14	14	14	21	14*

Good: 1-10, 12-17, 19-23
Fair: 11, 27-28
Poor: 18, 24-26
Es: 2, 8-9

CENTRAL UNITED STATES TO:

ALASKA	14	7	7	3	3	3	7	7	7*	14	14	14
ARGENTINA	14	7#	7#	7	7	7	14	14	14	21	21*	21
AUSTRALIA	14	14	7#	7#	7#	7#	7	7	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	21
ENGLAND	7	7	7	3	3	3*	7	14	14	14	7#	7#
HAWAII	14	14	7#	7	7	7	7	7	14	14	14*	14*
INDIA	7	7	7#	7#	3#	3#	7#	14	7*	7#	7#	7
JAPAN	14	7#	7#	7#	3*	3*	7	7	7	7#	7#	14
MEXICO	14	7	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	7*	7#	7#	3#	3#	7	7	7	7#	7#	14
PUERTO RICO	14	7	7	7	7	7	14	14	14	14*	14	14
SOUTH AFRICA	7	7	7	7#	7#	7#	14	14	14*	14*	14*	14
U. S. S. R.	7	3	3	3	3#	3#	7#	14	14	7#	7#	7

J. H. Nelson

WESTERN UNITED STATES TO:

ALASKA	14	14	7	7	3	3	3	3	7	14	14	14
ARGENTINA	14	14	7#	7	7	7	7#	14	14	21	21*	21*
AUSTRALIA	21*	21*	14	7#	7#	7	7	7	14	14	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	21	21*	21
ENGLAND	7	7	3	3	3	3#	7#	7#	14	14	7#	7#
HAWAII	21	14	14	7	7	7	7	7	14	14	21	21
INDIA	7#	14	7#	3#	3#	3#	7#	7*	7*	7	7#	7#
JAPAN	14	14	14	7#	7	7	7	7	7	7#	7#	14
MEXICO	14	7	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14*	14	14	7#	7#	7#	7	7	7	7#	7#	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	21	21	14
SOUTH AFRICA	14	7	7	7#	7#	7#	7#	14	14	14*	14*	14
U. S. S. R.	7#	3#	3	3	3#	3#	7	7*	7*	7#	7#	7#
EAST COAST	14	7	7	7	7	7	7	14	14	14	21	14*

Very difficult circuit this hour.
* Next higher frequency may be useful this hour.

Leo I. Meyerson
W0GFQ

LEO SAYS: BUY DIRECT AND *SAVE BIG* ON THESE *WRL HAM EXCLUSIVES*

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Overall ht. — 18'. Tubing diameter — 1 1/4" to 7/16". Max. unguyed wind survival — 50 mph. — Mtg. bracket for 1⅝" mast. Wt. 5 lbs.

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Maximum power: 1000 watts AM or CW — 2 KW PEP. Omnidirectional. Vertical polarized.

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Low cost, compact, 6 meter transceiver

Stable superhet receiver. 5 watt transmitter, featuring PTT, using std. (Ft 243) 8 Mc range xtals, non-critical coils, plate modulation, power and modulation indicators, 10 tube performance. Step-by-step manual included. Wt. 9 lbs. 115 VAC Power supply (kit) — **15.95.**

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- **5 Watt input**
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- **49-54 Mc coverage**

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Universal Power Supply: Powers most AM rigs up to 100 watts, SSB units — up to 200 watts, PEP. Silicon rectifiers provide both 300 VDC & 600 VDC @ 300 Ma., ICAS (210 watts total), plus 6 VAC @ 10A or 12 VAC @ 5A, plus 95 VAC @ 10 Ma. Size 11¼" x 4¾" x 6". Wt. 15 lbs. Kit — **24.95,** Wired — **39.95.** Opt'l cabinet — **4.95.**

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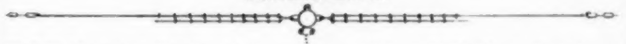
- **Use with 30-200 watt XMTRS—XCVRS**
- **Dual voltage B + Fil. power-bias**
- **Customized units available—Extra**

DUO-DOUBLET 84



NEW 80-40 meter diapole using proven parallel diapole principle to resonate on both bands. Requires only one 52 ohm feed line (coax not supplied). Kit includes wire, insulators, center connector & full instructions. Complete formula supplied & quick graph chart for easy adjustment. May be used on **15 meters also.** SWR: Better than 2:1 at resonance — 80/40. Max. length — 123 ft.; 140 ft. for lowest CW range. Easy to install. Wt. 4½ lbs. Shipped Parcel Post.

80-40 Meter Diapole
One Feed line

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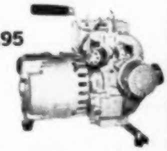

Shielded ignition. 1250 Watts, 115 VAC, 60 cy., 77 lbs.
(FOB Milwaukee, Wisconsin)

SS-3 "Q" MULTIPLIER

- **Notch and peak**
- **Self Powered**
- **One simple receiver connection**

Int'l 115 VAC P.S. Plugs into Collins 75S-1, KWM-2 & others. Use with receivers having 455KC-IF: AC or DC powered. Adj. selectivity: 300 cy. to 10 KC. Sharp rejection (50DB) null for hetrodynes. 6¼" x 4¼" x 4¾".

$15.95
kit

ANTENNA TUNER MM-100

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kit

Specifically designed to match end-fed long wire which is ½ wave, or multiples thereof, to 50 ohm transmitters. Panel lamp indicator. For inputs up to 150 watts SSB, 100 watts CW, 75 watts AM. 4' x 5 x 4 steel case. Reduces TV1.

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WRL NUVISTOR PREAMP PRINTED CIRCUITS

PA50-2 Stage preamplifier for 6 meters. Use 2 RCA 6CW4 nuvistors. Highest grade glass epoxy board. Assembled and pre-aligned for 50 ohm input-output. Requires 60-120 VDC @ 10 MA. & 6.3 VAC
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